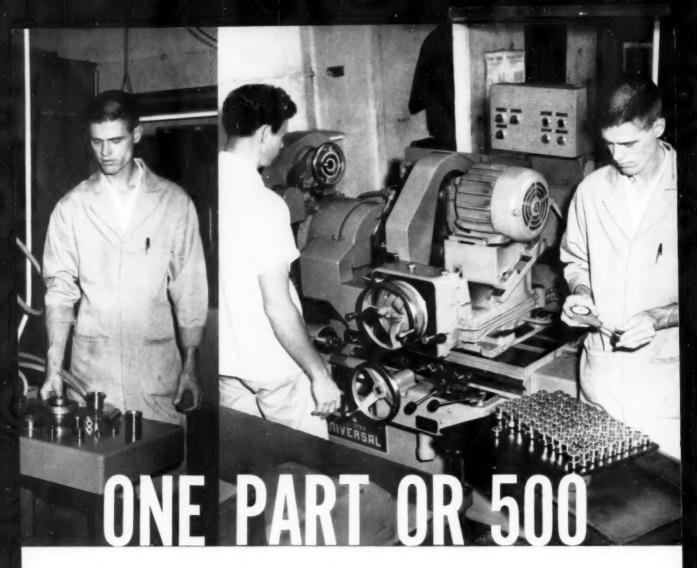
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# TOOLENGINEER

MAY 1960

electronic inspection

AMERICAN SOCIETY OF TOOL AND MANUFACTURING TENGINEERS



Selco gets top grinding performance at rock-bottom cost with the

## NEW HEALD MODEL 273A UNIVERSAL

The Heald Model 273A Universal Internal Grinder shown above is installed at the Selco Grinding Company — a small but busy job shop in southern California. Here it is used to grind straight or tapered I.D.s and O.D.s, and for rotary surface grinding of flat, convex or concave surfaces of a wide range of work — from individual parts to production runs. And it easily handles every job with far greater speed, accuracy, precision and finer finish than could be obtained on any of their previous equipment,

Until the advent of this Universal Grinder, most small job shops (and many larger ones, too) couldn't afford a machine of this type. But the Heald 273A costs about half as much as comparable machines today, and less than similar machines (with fewer features) cost in 1947!

Incorporating the latest advances in the grinding art, it holds tolerances to within .0001" in routine production, and within .000050" in special cases. Features include hydrostatic antifriction ways, full 20" table travel, several wheelhead positions, infinitely variable workhead speed from 150 to 450 rpm and 90 degree workhead swivel for rotary surface grinding.

Ask your Heald engineer for information on the New 273A — the only completely new machine with 1959 performance and a 1947 price tag.

# THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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It PAYS To Come To Heald

# the tool engineer

Vol. 44, No. 5

## May 1960

Creative Manufacturing is

The Future of Automation	79
Camless U-bend and forming die punch for piercing thin tubing setscrew orienter for automatic assembly special boring bar.	85
Controlling Bar Stock Whip	89
Putting Electronic Gages to Work	93
Quality Tooling Proves Economical	99
Heat-Treatment of Tools with Salt-Bath Furnaces	105
In-Process Inspection—A Must in Missile Machining	109
Numerical Control Increases Turret Lathe Output	117
Improving Reliability of Automatic Assembly Operations	119
Milling High-Strength Alloys (Reference Sheet)	123
ASTME IN ACTION	129

President's Editorial 77
Designed for Production
Engineering Bookshelf
Field Notes
Letter from the Editor
Looking Ahead (Newsletter) 254
Men at Work
Progress in Production
Readers' Viewpoints
Tech Digests
Technical Shorts
Tool Engineering in Europe
Tools at Work
Tools of Today (New Products)
Trade Literature
Who's Meeting and Where

#### THIS MONTH'S COVER

With electronic gages, deviations of a workpiece from a standard are magnified and read from a meter or permanently recorded on paper. Here the roundness of turned workpiece is being compared with the roundness of a master blank. Many other applications of electronic gages are described in the article starting on page 93.



THE TOOL ENGINEER is regularly indexed in the Engineering Index Service and Applied Science & Technology Index. The magazine is available to libraries and other institutions in microfilm form.

# Dependable DESEGATIZED FM Die Steels

. . . easier to work . . . easier to machine

In the production of thousands of metalworking dies, the properly dispersed alloy sulphides in Latrobe's FM High Alloy Die Steels have permitted increased feeds and speeds—machining time cut up to 15% in most cases! This cost-saving production is possible with no sacrifice of the excellent toughness, wear resistance and hardenability properties of the steel.

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Four grades of 12% chromium FM steels are regularly stocked: Olympic FM (type D-2) for long-run applications; BR-4 FM (type D-7) for extreme abrasion resistance; GSN FM (type D-3) for severe non-deforming requirements; Cobalt Chrome FM (type D-5) for extra resistance to galling and pickup.

For better die steels and technical service, call your nearest Latrobe representative. Literature on grades available upon request.

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## Challenge of Safety!

Safety in a changing world held the attention of engineers, management, labor and government in a recent three-day President's Conference on Occupational Safety. An annual event, it focused the cooperative efforts of those interested in the welfare of the worker on the common problem of providing safer working conditions.

Secretary of Labor James P. Mitchell pointed out the fact that disabling work injuries increased eight percent during 1959. Also, work deaths increased four percent in the same period. This has resulted even though more safety measures have been applied to more industrial operations. The reason for this alarming situation is that there is an ever increasing number of inexperienced workers joining our labor force. This problem will increase in the next decade and will demand the best efforts of industry to minimize hazards and to make all operations as safe as possible.

Next year, more than 26 million workers will be added to our work force. Preventing needless waste of manpower through accidents will require greater attention to teaching safety. The time-honored concept of "work safely" is becoming obsolete through split-second decisions required of workers in presentday operations.

Automation has done much to increase safety at work. In fact, it was originally conceived to minimize hazards in press forming operations. In this type of mechanization and similar automatic operations, the regular machine operators have been replaced by machine watchers and maintenance men. New dangers have been created as a result. Boredom with work itself has become a critical hazard. The hypnotic effects of monotony have led to accidents beyond proportions that could be anticipated.

It should be remembered that the speed of machines has changed but man himself has not changed basically. The tool engineer's challenge is clear: He must anticipate where danger will develop and protect the worker through redesign of tooling, change in process, and improvement in methods or through secondary remedial devices such as mechanical safety gates, electrical interlocks and electronic fences. He cannot afford to wait for an accident to occur. He must prevent it before it can hap-

Our aim, as the President has so aptly said, is "to bring about a better safety record in all places where Americans are at work."

> In W Gren EDITOR



# Compression-type chuck hikes tool performance

Find the jobs on which costly machines are being used as tool-setting fixtures, and we can show you how to save big money with quick-change, preset tooling. For example, you can change a boring head (or other shank-type tool) using this chuck, in seconds . . . without compromising accuracy, rigidity, or cost. Duplicate boring heads are preset outside the machine. A presetting stop in the chuck body controls tool positions accurately. The patented "Lock-and-Eject" nut on the end of the chuck turns on ball bearings. The operator just twists it to quickly unseat the tool. Opposite direction of rotation forces a split liner into

compression between the tapered ID of the chuck body and the tool shank. It's so simple to change tools—yet you can tighten the chuck in seconds to produce a powerful, no-slip

drive. No runout, no babbit hammers, no in-the-machine adjustments—no danger of slippage under a heavy cut. Ask your Scully-Jones distributor or representative for complete details.



MAXIMUM MACHINE UTILIZATION "Better-Hold" Chuck U. S. Patent No. 2709600



1915 S. Rockwell St., Chicago 8, III.

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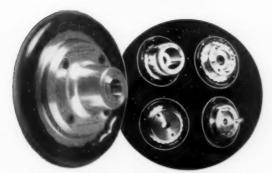




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**HV-4** Production

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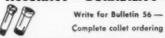
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# Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



# Fabricator Reduces Punching Costs by Changing to Omega Tool Steel

This picture, taken at Dave Steel Co., for hardnesses up to Rockwell C-59, Asheville, N. C., shows Bethlehem Omega tool steel punching a 1/2-in. diam hole in a structural angle about 3/s-in. thick. The fabricator reported that the Omega performed as though the structural steel were so much butter. It produced thousands of clean, burr-free holes of uniform size, resulting in an 18 pet reduction in punching costs, as compared with the grade formerly used.

Omega is our "super" grade of oilhardening, shock-resisting tool steel. In addition to being a long-wearing grade, Omega offers maximum shock-resistance

Omega tool steel can be quenched in oil at 1625 F. It also offers the advantage of water quenching from 1550 F.

#### TYPICAL ANALYSIS

C	Mn	Si	Mo	V
0,60	0.70	1.85	0.45	0.20
Besides	s its use i	n punche	s, Omega	is also
ideal f	or calki	ng tools,	beading	tools,
shear	blades a	nd chipp	oing chis	sels—in
fact, ar	ny severe	service i	nvolving	drastic
and re	peated in	paet.		

If you would like full details on Omega tool steel, get in touch with your Bethlehem tool steel distributor.

## BETHLEHEM TOOL STEEL **ENGINEER SAYS:**



#### **Pack Hardening Tools?** Be Sure to Use a Thermocouple

When pack hardening tools to reduce scaling and decarburization, it's a good idea to place a thermocouple in the pack, against the tools, to check accurately the time the tools are at heat. Failure to do so may lead to trouble.

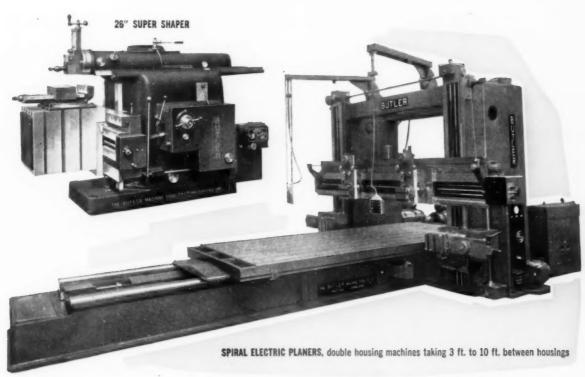
For example, an experienced heat-treater pack hardened a large-diameter die ring made of Bethlehem Lehigh H tool steel. Then he checked the hardness. Imagine his surprise to find it was only Rockwell C-48. Puzzled, he checked the furnace pyrometer charts. They showed that the recommended heating cycle had been followed. But why such a low hardness

A Bethlehem contact metallurgist suggested that the die ring be rehardened, and that a thermocouple be inserted in the pack against the ring. After this was done, and the cycle repeated, the hardness jumped to Rockwell C-60. It was noted that the time required to heat the tool was 50 pct greater than in the first cycle. Thus the heat-treater had proof that in the initial treatment, the die ring was not heated long enough to reach proper temperature, despite the fact that the furnace pyrometer apparently indicated the correct heating cycle.



#### Upset-forged Discs Are Easy To Machine

Bethlehem upset-forged discs, made of Cromo-WV (H-12) tool steel, are ideal for aluminum extru-sions tooling because of the basic 5 pct chrome analysis. They are also economical because of their easy machinability, and ease of heat-treat-ment. They're made with exacting care, and are finished in ring dies to insure good section and sharp edges. Moreover, Cromo-WV has good resistance to washing and heat checking.





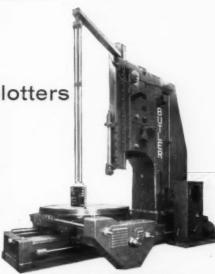
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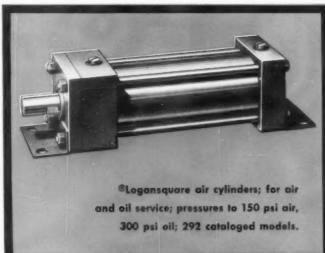


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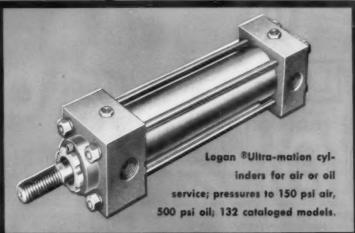
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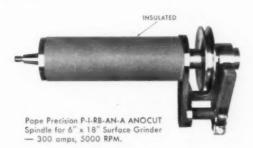
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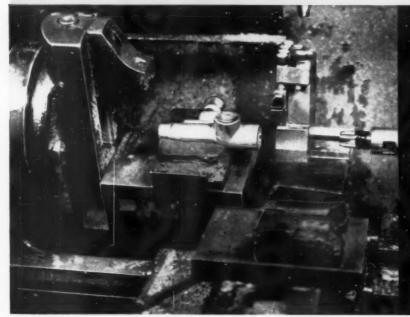
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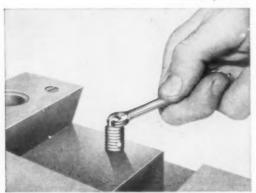
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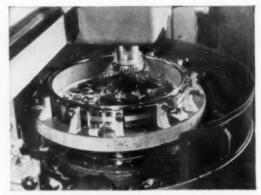
# Practical Tooling Tips

No. 4 of a serie

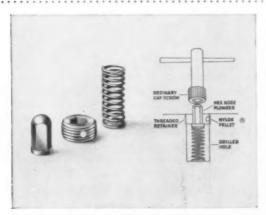


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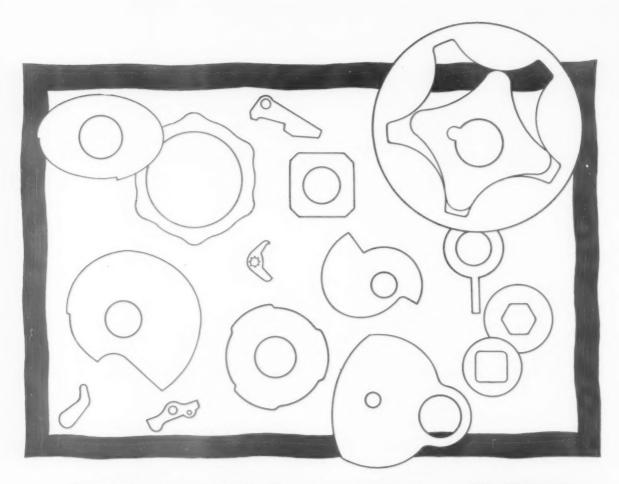
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If your work includes heavy stock removal on big parts, you will be interested in this setup. Here one man with two Gisholt MASTERLINE No. 24 Automatic Chucking Lathes cuts time an average of 30% on work formerly done on three older machines!

Work includes a large variety of bevel and spur ring blanks for heavyduty automotive gears from 18" to 33" O.D. These tough steel forgings are produced in lots of 20 to 200 pieces on a 3-shift basis five days a week. The machine selected had to combine ruggedness and dependability with a fast, automatic cycle and quick changeover—all vital to profits. This is where the No. 24 shines.

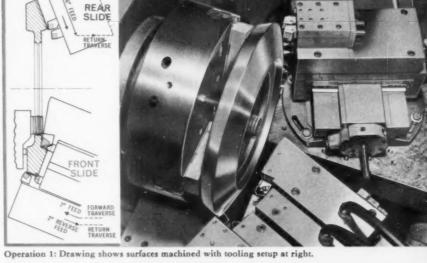
According to the user, Fairfield Manufacturing Company, Lafayette, Indiana, a 68% saving was obtained on the 24½" O.D. bevel ring gear setup shown:

FIRST OPERATION—10.5 minutes f.t.f. on the No. 24 as compared to 31.5 minutes on the older machines. SECOND OPERATION—11.75

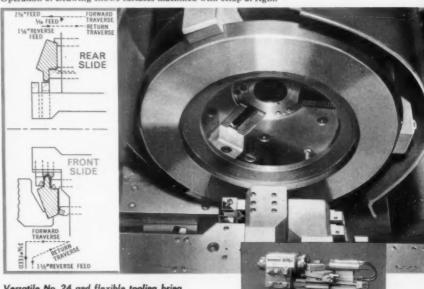
minutes compared to 38 minutes.

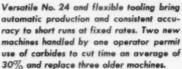
The drawings show how the various surfaces are handled by the tooling on the front and rear independent slides.

Change-over is fast—approximately 2½ hours from size to size on similar parts and five hours maximum type to type. The front carriage has an adjustable base and the front and rear independent slides are mounted on 90° angularly graduated swivel bases. Each independent slide has two forward feed rates and one reverse feed—all available during the automatic cycle. Reverse feed simplifies the holding of close tolerances and provides required fine surface finish.



Operation 2: Drawing shows surfaces machined with setup at right.





For complete information on the Gisholt No. 24 Automatic Lathe, circle No. 715 on Reader Service Card.



## HOW GLOBE OIL TOOL GROOVES ROTARY ROCK BIT CUTTERS 500% FASTER

#### One basic tooling setup handles two operations on wide variety of similar parts

One of the toughest jobs in manufacturing rotary rock bit cutters is the machining of deep grooves in the tough steel forgings. The machine must be rigid and powerful for maximum metal removal and long tool life. It must also be versatile to economically handle a variety of sizes, in small lots.

To meet all these requirements, Globe Oil Tool Co., Los Nietos, California, selected a Gisholt Simplimatic Automatic Lathe. Not only did the Simplimatic replace three older lathes, it reduced machining time 80%

Each cutter requires two operations. Tooling is carefully planned so that one basic setup will handle both operations on all sizes from 57/8" to 18". Lots range from 25 to 1000

The first operation consists of rough- and finish-turning the cone Second operation setup for grooving the 6½" steel rotary rock bit cutter shown at far right, inset. Other parts, from left to right: rough forging; after first operation; three different cutter types produced from the one size forging.



One basic setup handles all sizes and types. Swivel-base tool slides are quickly set for correct cone angles. Open-face tool blocks permit addition or removal of tools.

For complete information on the Simplimatic, circle No. 716 on Reader Service Card.



O.D. with tools on the front and rear independent slides. The second operation, grooving, is divided between the front and rear independent slides. The slides operate simultaneously during both operations. F.t.f. times, for the 61/8" cone shown: first operation, 1.2 minutes; second operation, 2.5 minutes.

## FOUR-STEP BALANCING OPERATION COMPLETED IN ONE HANDLING

#### Work is driven from below to eliminate belt-lifting for faster production

Every balancing operation consists of four basic steps: location of angle; measurement of amount; unbalance correction; inspection. This 1S Balancer setup, in the plant of a wellknown automotive manufacturer, demonstrates how all four steps can be completed in one handling.

The workpiece is a 9-lb. alternator rotor assembly. It rests on top of the driving belt, eliminating the need to raise the belt to load and unload.

Because Gisholt Balancers indicate the angle and amount of unbalance electrically in each correction plane, there is no guesswork by the operator. The strobe lamp shows the exact angle of unbalance on a numbered disc. The amount meter is calibrated in units of depth of a 1/2" drill starting at a 21/4" radius.

An air clamp arrangement lifts the work out of the supporting fixture and holds for correction drilling. Two drill spindles drill at the indicated angles to the depths shown on the amount meter, correcting for balance in each plane.

Driving work from below eliminates belthandling, ups production to 44 parts per hour at 80% efficiency. This includes locating, measuring, correcting and inspecting for balance in each plane.

Operator about to make drill correction in right correction plane. He matches meter reading with depth dial on drill head, eliminating guesswork. Special work-holding and thrust device prevents damage to supporting fixture.

For complete information on Gisholt Balancers, circle No. 717 on Reader Service Card.





Strobe lamp, focused on numbered disc on left hub of part, clearly shows exact angle of unbalance in each plane. Note direct-reading amount meter, electrically calibrated in units of drill depth to minimize operator effort.

#### HOW CRANE LTD. TURNS OUT NEW VALVE LINE AT PEAK EFFICIENCY

Crane Ltd., Montreal, Quebec, Canada, in setting up to produce a new valve line, investigated the many claims being made for latest automatic machining methods. Crane's work included intricate contours on both bar and chucking jobs in a wide variety of sizes. The two setups shown here are giving Crane the cost-cutting efficiency it hoped to find.

#### Gisholt No. 5 Automatic Ram converts quickly to bar or chucking work

The tooling setup shown at right, on a MASTERLINE No. 5 Automatic

Ram, is typical.

A special octagonal turret and front and rear tools on the cross slide provide ample tooling stations to complete most parts in a single operation. Spindle speeds and machine functions such as bar feed, collet operation, turret index, traverse, feed selection, turret return and cross-slide operation are preset. Reduced pressure for threading, and a die-head cocking device are also preset.

Setup is as fast as for a handoperated ram type turret lathe. Only minor tool adjustments and tool changes are needed for the entire

work range.

On bar work, the lathe requires

attention only when stock is exhausted or when chips must be cleared. On chucking work, the operator loads, starts the cycle and unloads. In addition to fast machining, optimum tool life and consistent quality at fixed production rates, the automatic cycle allows the operator to do other work.

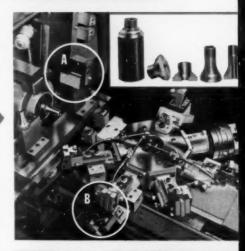
Inset shows typical bar jobs. Each is produced in one automatic operation.

Tooling setup for part at right, an inside screw union bonnet for a 1½" cast steel, 600 p.s.i. gate valve, produced from 3", cold rolled C-1026 bar stock.

A retracting locator (A) acts as a stock stop. Turret tools turn the O.D.; drill, bore, form, face, chamfer and thread the O.D. A plunger (B) recocks the die head during indexing. O.D. radius is formed from rear of cross slide. Finished part is cut off from front of cross slide, and cycle repeats. Time, 4.2 minutes f.c.f.

Get the facts on the Gisholt AR (Automatic Ram) Turret Lathe. Circle No. 718 on Reader Service







Inset shows two typical parts. Each is machined at both ends in one chucking. The ½", 600 lb. cast steel gate valve body at the right of the inset is handled with the setup shown. First, one end is machined, requiring one complete index of the octagon turret. The work is indexed 180° and another complete index of the turret finishes the other end. Total time, only 3.20 minutes f.t.f.

Tracing provides highest accuracy and eliminates chance of error on contours, etc. Since all diameters are finished with one tool, only one dimension needs to be checked greatly simplifying inspection. Again, the automatic cycle frees the operator for other work.

For complete information on the Fastermatic, circle No. 719 on Reader Service Card.



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE

# Fastermatic with JETracer handles I.D. contours automatically

Intricate contours on opposing inside diameters of over ten different parts are handled automatically on a Gisholt MASTERLINE 2F Fastermatic. These include five sizes of 600-lb. cast steel gate valve bodies ranging from ½" up to 2".

In selecting a machine for this work, Crane Ltd. wanted the versatility of tooling usually found only in a manual turret lathe, and automatic cycle production. Also, the machine had to handle a wide range of parts in long and short runs with minimum tooling and quick change-over. All these requirements were met by a 2F Fastermatic equipped with a turret-mounted JETracer slide tool and an indexing work-holding fixture.

Here are other features that provide the versatility to handle the wide range of work economically:

Octagon Turret—provides maximum tooling stations permitting complex work to be completed in one chucking on most parts; Automatic Spindle Positioner—to reduce loading-unloading time;

Automatic Forward-Reverse of Spindle
—for all types of threading work
using die-heads or taps;

Turret Threading Attachment—to produce high-quality, close-tolerance threads:

Two-Speed Motor—to assure proper surface speeds for turning, boring, threading, forming, etc.;

Turret Facing Attachment—to actuate turret-mounted recessing tools.

The most unusual feature of this setup is the use of a turret-mounted JETracer slide tool, operated automatically during the machining cycle. The flat template is held in a sliding bracket that obtains length location by engaging a stop bar on the side of the overhead pilot bar. Continued forward feed of the turret saddle causes the tracer stylus to follow the template contour, governing movement of the single-point tool on the tracer slide.



Operator inserts C-clamp on draw rod and holds brake drum against adapter to centralize and locate while actuating foot control to clamp the part. During the automatic cycle, .003" to .005" stock is removed and a "controlled" surface finish of 50 micro-inches RMS is produced. Time, 15 seconds f.t.f. Inset left, bored part; right, part after Superfinishing operation that eliminated intermediate grinding.

# SUPERFINISH ELIMINATES GRINDING AND IMPROVES BRAKE DRUM QUALITY

#### Superfinish provides greater area contact, removes smear metal for longer life

Superfinish saves in many ways: Equipment cost is low. "Controlled" finishes are obtained in seconds. Part geometry is improved. A better surface is produced, with "peaks" removed, leaving plateaus and valleys for greater area contact. Surface smear metal is "scrubbed" away, exposing true base metal for longer service life. Superfinishing can also be used for stock removal as well as for fine finish. In many cases, parts are turned or faced and then Superfinished—eliminating intermediate operations.

All these points are demonstrated by this setup on a Gisholt Brake Drum Superfinisher. The workpiece is a cast iron drum with an 11" diameter 2\(\frac{7}{6}\)"-deep braking surface. It comes to the machine bored within limits of plus .005", minus .000", and has a

surface finish of approximately 250 micro-inches RMS.

It is loaded with the open end towards the headstock. An adapter locates and centralizes against the inside of the mounting flange. A C-clamp is slipped on a draw rod extending through the small bore to hold from the other side. When the automatic cycle starts, two sets of Superfinishing stones expand, contacting the I.D. One set of stones roughs, removing from .003" to .005" of stock. The other set finishes, producing a "controlled" 50 micro-inch RMS surface. Time, only 15 seconds f.t.f.

Superfinish can save and improve quality for you, too. Gisholt has a complete line of general-purpose, high-production or special Superfinishers to meet your every need.

For complete information on Superfinishing, circle No. 720 on Reader Service Card.

# ACME INDUSTRIAL THREADS STAINLESS 467% FASTER, ELIMINATES REJECTS WITH CRI-DAN

#### Threading an I.D. taper up to a shoulder eliminates heattreat distortion problem

Producing a 20 TPI NF Class 3 thread right up to the shoulder in the bore on the hex end of this 440C stainless spool valve presented a host of problems—problems that could be handled economically only on the Gisholt CRI-DAN B.

Acme Industrial Co., Chicago, Illinois, was producing this part in lots of 4000 pieces, using taps. First a standard tap...then a bottom tap at 15 pieces per hour for each operation. Breakage was excessive. After tapping, the part was hardened and the threaded end was annealed. Shrinkage at the base of the bore resulted in a tapered thread. This required another bottom tapping and often resulted in more broken taps. Rejects ran as high as 20%.

A CRI-DAN B Threading Lathe solved the problem by producing a tapered thread with the large diameter at the shoulder at the back of the bore. Shrinkage after hardening and annealing produces the desired straight thread. The thread is completed in 22 automatic passes with diminishing in-feed, for fine finish and easy holding of the .4675 "go, .4701" no-go tolerance. Production, 35 pieces per hour. A single-point carbide threading tool is used, which produces about 75 parts per grind.

5.03 minutes saved per part...tap breakage and rejects eliminated. Straight, tapered, multiple-start, left- or right-hand threads are standard with CRI-DAN. Here a single-point carbide tool is used to thread faster, more accurately, and at less cost than any other method.

For complete information on CRI-DAN Threading Lathes, circle No. 721 on Reader Service Card.





Operator uses gage for quick "on-center" positioning of threading tool. Part is centered and located for length in bushing in bore of special chuck having three slotted jaws. The slots retain a loose ring. Pressure distorts the ring, causing three swivel jaws to centralize, grip and drive on the hex O.D.

Rough and threaded part.





No. 5-660 760

The Gisholt Round Table represents the collective experience of specialists in the machining, surfacefinishing and balancing of round and partly round parts. Your problems are welcomed here. GMACHINE COMPANY

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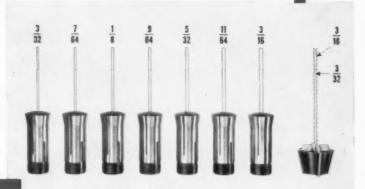
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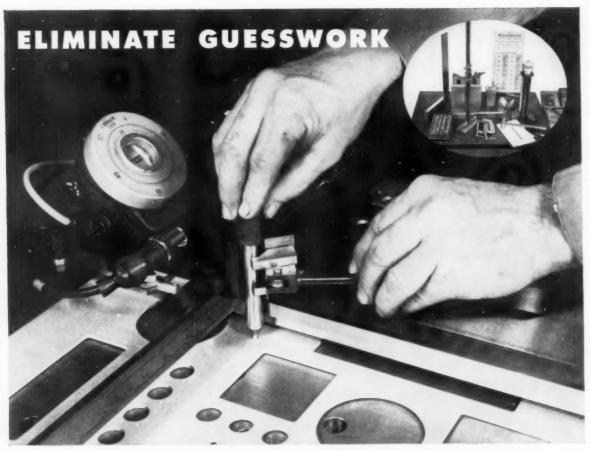
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The Wiedemann Inspector eliminates all of the slow, costly steps required with ordinary inspection methods. Consistent accuracy is assured.

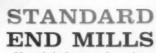


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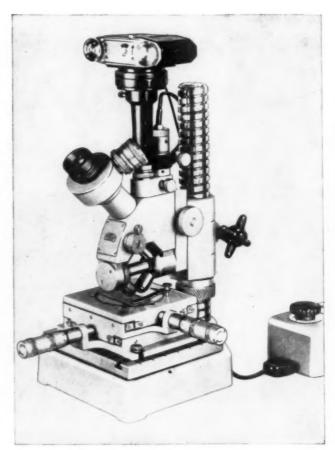
# **Light Section** Microscope

This microscope produces a profile of the surface being examined by the well known light-section method. Roughness depth, as well as the groove distances of machine-finished surfaces, can be measured. Internal surfaces can be examined by making lacquer replicas.

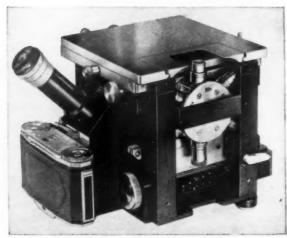
The newly developed revolving nose-piece for the objectives makes it possible to quickly change the magnification (height of profile) between 400x and 200x. At 400x, depths of roughness of 40 to 160 micro inches can be measured; at 200x, those of 120 to 4,000 micro inches.

Photographs for comparison and control purposes can be taken by mounting a 35mm miniature camera at top of the instrument.

In addition to the stage plate of the stand, a mechanical stage and center cradle (for turned parts) are available.



# Interference Microscope



## for measuring minute depths of roughness (80 to 1.2 micro inches)

This instrument, which has magnifications of 80x, 200x, and 480x, is designed especially for critical examination of super-finished surfaces, thickness of coatings, changes of surface structures due to wear, impact, stress, strain, corrosion, as well as for the studying of polished and etched metallurgical specimens.

It is equipped with built-in Thallium and white light illuminators.

A miniature camera, which is attached, provides photographs on 35mm film (1x1½").

Write for detailed literature on these instruments

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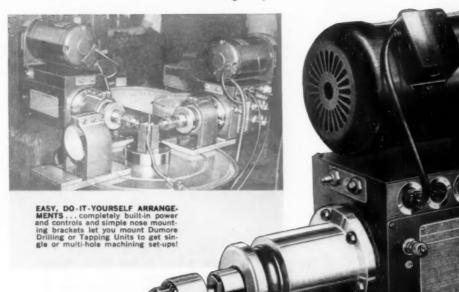
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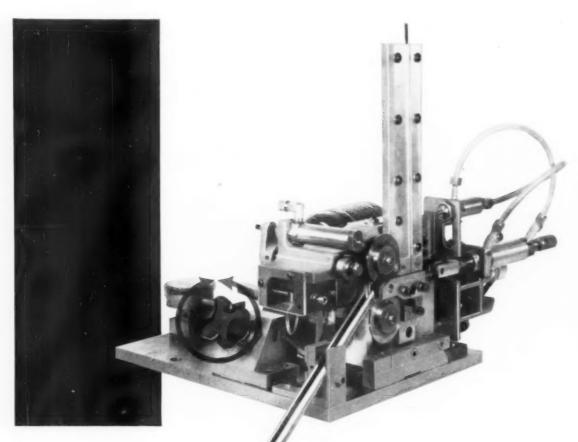
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Quick change "packaged tooling" is only one of the many exclusive features of the Bryant Model "B" Centalign — features which are helping manufacturers of miniature components establish new records for accuracy and production.

If you are grinding the bores or raceways in miniature bearings or similar parts, investigate the Bryant Model "B" Miniature Centalign. It will repay you in increased profits.

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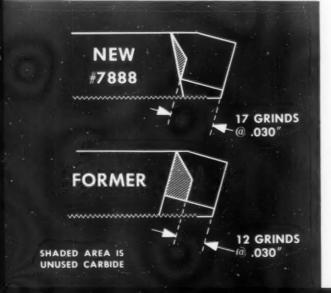
A new blade which provides an automatic average increase of 36% in blade life when milling such metals as cast iron, aluminum, magnesium or steel is now available for all Wesson Rigideut series 5200, 5400 and 5500 milling cutters.

Assuming that .030 in. is removed per grind, a total of 17 regrinds is possible with the new design as compared with an average of 12 regrinds on the former blade. There is also less carbide left to be scrapped when the blade is "worn out."

The new blades (series 7888) are being made available by Wesson at no increase in cost and may be used, without change, in existing series 5200, 5400 and 5500 Rigideut milling cutters.

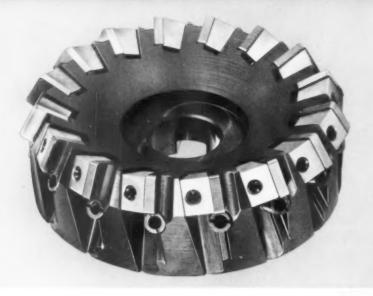
All three series of cutters are available in cutting diameters ranging from 4 in, to 32 in.

Blades are available for either RH or LH cutters.



More grinds and a minimum of carbide waste when "used up" characterize the new Wesson blade for Rigidcut milling cutters.

FOR FURTHER INFORMATION, CIRCLE READERS' SERVICE CARD A-1



# Throwaway Insert Cutters Adjustable for First Time

Milling cutters for throwaway carbide inserts with each insert individually adjustable to tenths of a thousandth are now available for the first time. The new development permits the use of throwaway inserts with commercial tolerances without face runout, and allows cutters to be used for finishing as well as roughing, if desired.

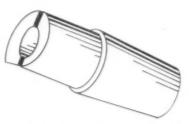
This major breakthrough in the use of throwaway inserts for milling is made possible by an extremely simple device. The axial support for each insert is a cam shaped pin which is taper-locked in position into the cutter body. To advance or retract the insert, a differential screw holding the pin in the cutter body is loosened. The pin is then turned the exact amount desired of insert advance, and the pin is again locked with the screw.

Total adjustment range is .030 in, for each insert, thus allowing for practically any combination of tolerance variations in a milling cutter assembly.

The milling cutter with the new adjustable pin is available as standard in a majority of lead angles and diameters ranging from 5 inches up.

For details, ask for Bulletin #358





To adjust a blade, the blade lock is loosened and the taper lock pin released by turning the screw within the taper lock pin. The pin with its uniform-rise cam seat is then rotated for the desired amount of advance, and pin and blade locks are tightened gagin.

FOR FURTHER INFORMATION, CIRCLE READERS' SERVICE CARD A-2

# carbíde

Which do you need?



#### Bulletin MF-260

Complete Prices and Specifications

#### Bulletin T-160

For Throwaway and Slug Type Inserts

#### Bulletin B-1259

Micro-Adjustable and Fixed Single and Multiple

#### Bulletin MF-360

End Mills, Counterbores, Lathe Centers, Core Drills, Reamers, Vises

#### Bulletin No. 358

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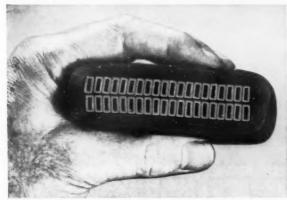
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# **BETTER WAYS** of doing things with seamless copper tube are unlimited—from capillary sizes to 26-inch diameter—round tubes or special shapes.

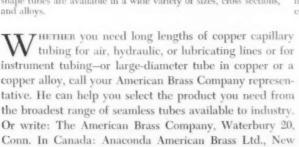


A better product faster. In the Kodak Roll Paper Dryer-Glazer shown below, photographic print paper travels around a heated, mirror-smooth, chromium-plated copper drum. This drum could be formed from sheet metal, welded and ground. But Eastman Kodak Company takes a production short cut and buys the drums ready made—Anaconda seamless copper tube 26" inside diameter, in wall thicknesses of %", cut to 20" lengths. Having the thermal conductivity and corrosion resistance needed, the tube is also easy to polish to a high mirrorlike finish (photo, left), provides an excellent base for fine chromium plating. No seams mar the surface. Production time and steps are cut.





Rectangular copper tube carries current and coolant. By liquid cooling conductors in generator stator bars, General Electric has opened the way to doubling generator ratings without appreciably increasing frame size. Tubes, approximately 0.300" x 0.130" O.D., shown in cross section above, are shipped in long coils. Special-shape tubes are available in a wide variety of sizes, cross sections, and alloys.





High-precision tubes meter fluids. York Corp., subsidiary of Borg-Warner, has found restrictor-tube metering of refrigerant in packaged air-conditioning units up to 25-ton capacity has greatly reduced field service, made possible the 5-year protection plan on all units. Anaconda Copper Restrictor Tubes have consistently met York's strict requirements. These tubes are available in copper or aluminum in nominal I, D.'s from .025" to .090".

# ANACONDA

SEAMLESS COPPER TUBE
CAPILLARY TUBE • SPECIAL SHAPED TUBE

Made by The American Brass Company

Toronto, Ontario.

# No other tracer attachment has all these features

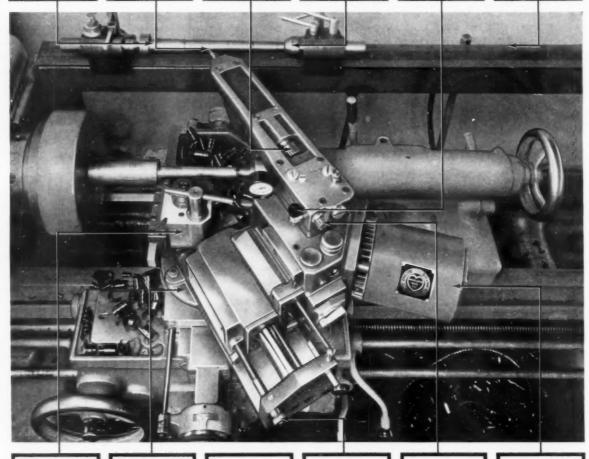
Traces from any template (round, flat, wood, metal) or standard product. Tracer controls tool in continuous path for smooth, accurate finish.

Micrometer adjusts for cutting over, under or exact size.

Adjustable eccentric on template protects lathe tailstock.

Easy-to-reach control knob initiates or interrupts cycle.

Template rails furnished any length and with brackets to fit any lathe.



Tool post and holders designed for quick change of pre-set tools. Complete swiveling for turning, boring or internal cutting at any angle.

Does not limit utility of lathe . . . regular turning can be done with tracer installed.

Positive stop locks unit for non-tracing

Adjustable valve controls feed rate for non-tracing work.

Close-coupled motor and pump eliminates hoses, assures sensitive control.

For far less than you would imagine, you can quickly convert any good lathe for turning multiple diameter shafts or for turning, facing and boring contoured workpieces . . . single pieces or high production. Three sizes to fit any lathe up to  $27\frac{1}{2}$ " swing and up to 30 horsepower.

Write for complete information.



LELAND-GIFFORD

WORCESTER 1, MASSACHUSETTS

HYDRAULIC LATHE TRACER ATTACHMENT

A NEW "COMPACT" HITS THE MACHINE

# THE NEW HARIG 612

SURFACE GRINDER

with

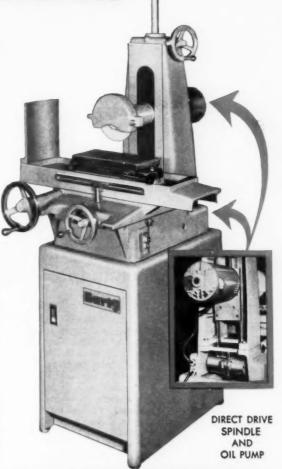
- \* Automatic forced lubrication goes into operation as soon as machine is started triples life of the ways and preserves original accuracy.
- \* Direct drive spindle
  increases power . . . reduces vibration . . . no
  V-belts to replace.
- \* Your choice of right or left hand longitudinal feed

All Standard Equipment

The new 612 represents a break-thru in design and construction whereby Harig now offers industry a low-cost, precision surface grinder loaded with features usually found only on expensive models. Easy to operate . . . requires little maintenance . . . built with the precision quality you expect from Harig.

#### GET ALL THE FACTS ...

Write for brochure on the Harig 612 Surface Grinder



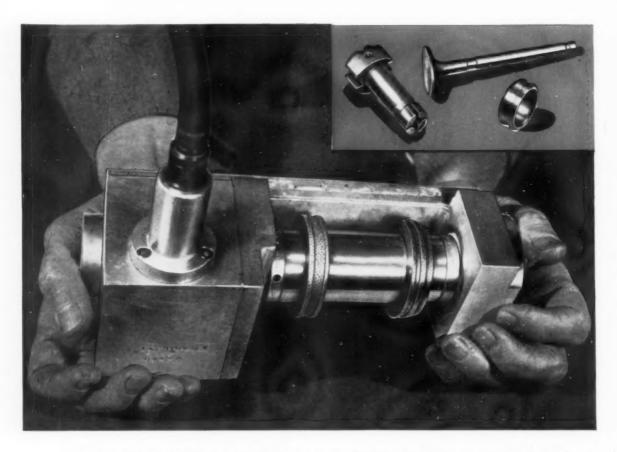


HARIG'S NEW IMPROVED GRIND-ALL FIXTURE

Easily grinds irregular shaped perforators concentric with shank within ± .0001 accuracy. Also can be used as milling, boring and inspection fixture. NEW ATTACHMENTS: Radius Dresser Arm and Ball Seat Punch Adapter. (Write for new Grind-All Brochure.)



5745 W. HOWARD ST. . CHICAGO 48, ILL.



# THIS TRU-GRIT® ROTARY DIAMOND DRESSING WHEEL forms grinding wheels with speed, accuracy and economy unapproached by any other method

It form dresses ANY grinding wheel—vitrified, resinoid, silicate, rubber or shellac bond. It has none of the limitations of crusher roll or single point diamond tool forming; it develops complex configurations and sharp, deep, square grooves with absolute accuracy, assuring exact reproduction in the work piece. It may do this in a single, quick pass between ejection and loading, without interrupting the production cycle. Downtime for tool changing on every shift is out; the Tru-Grit Rotary Diamond Dressing Wheel's finishing and dressing life goes far beyond anything known before. Savings

in downtime, the increased number of pieces produced, the lower cost per piece over the life of the Tru-Grit Rotary Wheel are things to make cost engineers take a second look. But, perhaps the most dramatic difference of all is in the meticulous accuracy, fine finish and routine uniformity of the processed pieces. This is what quality control engineers have dreamed about and it makes quality control reports something of a formality. If you'd like facts and figures on actual applications of the Tru-Grit Rotary Diamond Dressing Wheel, write us.



#### WHEEL TRUEING TOOL COMPANY

1910 SEMI-CENTENNIAL 1960

Main plant and office: 143-3200 W. DAVISON, DETROIT 38, MICHIGAN
Southwestern plant: DALLAS, TEXAS • Western plant: LOS ANGELES, CALIFORNIA
Eastern affiliate: WHEEL TRUEING TOOL COMPANY OF NEW JERSEY, BLOOMFIELD, N.J.
Canadian plant: WHEEL TRUEING TOOL COMPANY OF CANADA, LTD., WINDSOR, ONT.

#### Oldest and largest diamond and diamond tool specialists in the Western Hemisphere

INDUSTRIAL DIAMONDS . DIAMOND TOOLS . DIAMOND-MISER TOOL TURNING DEVICES . MINING AND OIL FIELD DIAMOND DRILLS . MASONRY DIAMOND DRILLS AND SAWS . PORTABLE DRILLING MACHINES AND SAWS

#### ASSEMBLE ACCURACY

into your special machines



EXTREME ACCURACY AND RIGIDITY... because rugged, unit-cast body assures precise alignment. Heat treated wear parts and precision ball and roller bearings used throughout.

FAST CYCLING . . . with multiple disc clutch and brake to engage and disengage feed train from spindle drive.

**VERSATILE...** because readily available commercial quick-change pick-off gears are used in feed train. Three

drive arrangements are available.

POSITIVE ACTION... and dependable performance through countless cycles. Closed cam design insures fast, positive quill return without use of springs.

**DATA...** 3½" stroke; 6000 rpm maximum spindle speed; 1000 pounds maximum thrust; 3 horse-power motor maximum.

FOR COMPLETE INFORMATION ... write for Catalog No. 508.



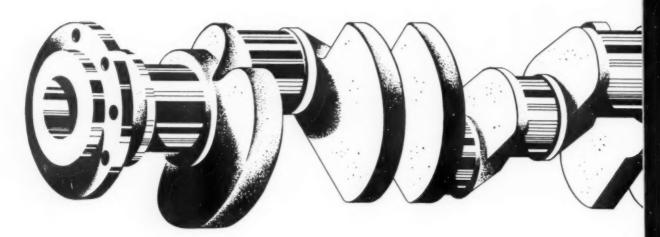
At the same time, ask for information on Hartford Special's lines of Air Hydraulic Drill Units, including the all-new Model 17-400.



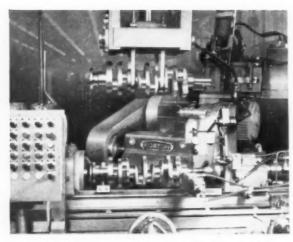
THE HARTFORD SPECIAL MACHINERY CO.

3800 Homestead Avenue, Hartford 12, Connecticut

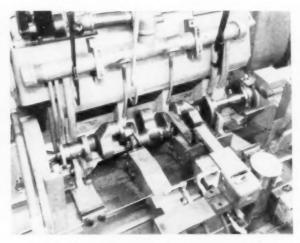
# If you grind crankshafts...



check how NORTON grinders can reduce your costs-per-shaft



**Grinding Gear Fits** and shoulders is easily handled on a Norton Type C-V 4 Angular Wheelslide Grinder. By grinding thrust surface and adjacent diameter in a single, automatically controlled plunge grind, the Type C-V 4 provides fastest production with less effort.



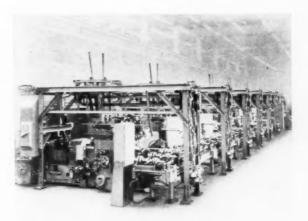
Grinding All Main Bearings At Once is a job for the Norton Type CM-1 Semiautomatic Heavy Duty Multi-Wheel Grinder. Precise finishing of a group of line diameters about as quickly as a single diameter grind assures important cost-savings. Also popular in this multi-wheel application are Type CTU Heavy Duty Cylindrical Grinders.

75 years of . . . Making better products . . .

NORTON PRODUCTS: Abrasivas + Grinding Wheels + Machine Tools + Refractories + Electro-Chemicals - DEHR-MANNING DIVISION: Coated Abrasivas + Sharponing Stones + Pressure Sansitive Tapes



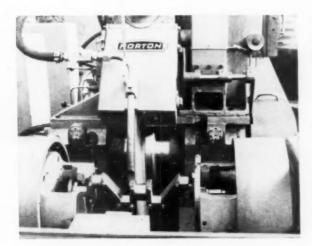
For further facts on how these grinders can benefit you, see your Norton Man, a trained grinding engineer. NORTON COMPANY, Machine Tool Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.



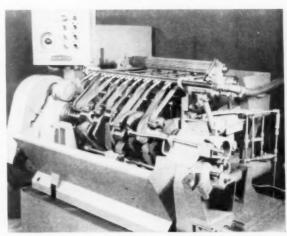
Automatic Grinding of Crankpins on a multi-station basis is handled on the No. 2 Unitized Transfer Type Crankpin Grinder. This machine combines loading, positioning, grinding, gaging, transferring and wheel-truing — a sensational advancement for big volume crankshaft production.



\*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries



Simplified Grinding of Pins on shafts up to 72" long is the specialty of Norton Type CC-8 CRANK-O-MATIC\* Semiautomatic Crankpin Grinders. Automatic cycling under semiautomatic control frees the operator from supplementary operations. Similar advantages for grinding pins on small shafts are provided by Norton Type CTU CRANK-O-MATIC Grinders.



Lapping Pins and Bearings simultaneously in an automatic cycle calls for the Norton No. 31 CRANK-O-LAP® Lapping Machine. Strips of coated abrasive are used as the Lapping medium in producing top-quality finishes. With headstock and footstock carried as a swing frame, manual operation is reduced to easy loading, pushing the "Start Cycle" button and unloading.

to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines - G & E DIVISION: Shapers . Gear Cutting Machines . Gear Induction Hardeners

#### MAGNESIUM TOOLING PLATE CUTS TOOLING **COSTS FOR MAJOR INDUSTRIES**

Magnesium tooling plate and extrusions have become accepted as essential tooling materials during the past six years by such cost-conscious industries as automotive, aircraft, missile, machine tools, and electronics. No other tooling material approaches magnesium's unique combination of cost-cutting properties . . . lightness, machinability, flatness, rigidity. You get more metal per pound with magnesium than with any other metal!



Unmatched machinability cuts machining costs.



Magnesium assembly jig Is easily handled by two men.

BEST PROOF of magnesium's acceptance as a tooling material is its actual use for: assembly jigs; trim and drill jigs; checking fixtures; templates; base plates; test equipment. Magnesium's acceptance is growing for a very good reason-its properties mean lower tooling costs, better all-around results!

LIGHTWEIGHT magnesium tooling is easy to build, use and handle, reducing fabrication and labor costs. This is the lightest of all structural metals, weighing only one-quarter as much as steel, one-third less than aluminum. Magnesium reduces worker fatigue and accidents, too.

MACHINABILITY, Magnesium is the easiest to machine of all structural

metals, for all machining operations . . . sawing, milling, planing, boring, tapping and threading, etc. For example, cutting speeds of up to 5000 feet/minute and cuts of 0.500" in depth are often used in turning. Even at these speeds and cuts, tool wear is less than with other metals.

FLATNESS. Lightweight tooling plate now has closer flatness tolerances than ever before-so close, in fact, that it can be used as purchased for nearly every tooling purpose. Surface machining is not necessary! This plate is rolled and stress relieved, and magnesium's dimensional stability keeps



Auto checking fixture retains dimensional accuracy.

SQUARE MAGNESIUM TUBING is the latest magnesium extrusion shape. This useful form fills out the complete line of extrusions which includes channels, tubing, and most other standard structural shapes.

Economical magnesium tooling materials have been proved and accepted by the country's major industries. Why not put their advantages to work for you? For a copy of the fact-filled booklet "Magnesium Tooling Plate Shop Manual," or for more information, contact the nearest Dow sales office or write THE DOW METAL PROD-UCTS COMPANY, Midland, Michigan, Merchandising Dept. 1031FJ5.



Square magnesium tubing is now available.

See "The Dow Hour of Great Mysteries" on NBC-TV



#### THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

Quality...the best economy of all



#### He does a better job when he can see what he's doing

You increase operator efficiency as well as production when you use transparent, heavy-duty Sunicut cutting oils. Operators work better, because Sunicut oils let them see tools and workpieces, see the finish, see micrometer graduations.

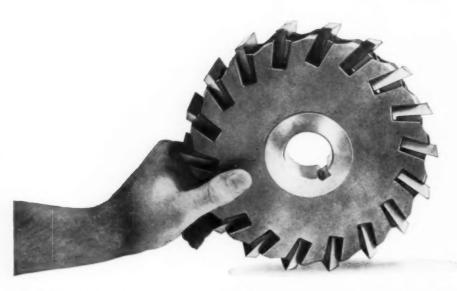
Sunicut oils don't stain hands and clothing. They pump easily, wet metal fast, and give excellent extreme-pressure lubrication.

To prove to yourself the economy of Sun quality, ask your Sun representative to help you select the right grade of Sunicut for your heavy-duty cutting requirements. Or write to SUN OIL COMPANY, Dept. I-13, Philadelphia 3, Pa.

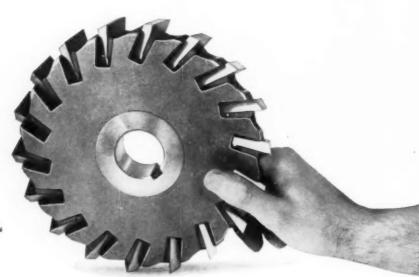
In Canada: Sun Oil Company Limited, Toronto and Montreal.

MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES





Which cutter will produce fewer rejects?



LOOK TO
INGERSOLL
FOR THE
ANSWER



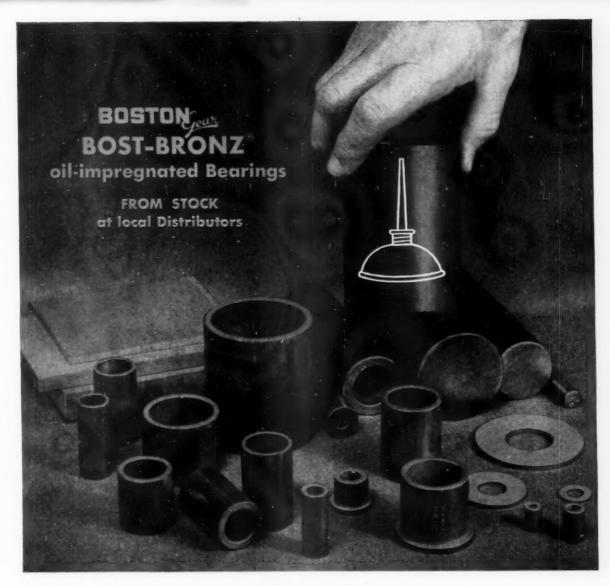
You haven't a chance to choose...both pictures show the same cutter! You see, there are many factors, other than cutter design, that can affect machining adversely and turn a piece into a reject. But you do have the chance to prevent trouble by analyzing all factors involved, in advance. Firms that rely on Ingersoll to assist in setting up procedures find the economical answers that

hold costly rejects to a minimum or eliminate them entirely.

Let an Ingersoll representative help you with a preliminary survey of your metal removal practices. It will cost you nothing... could lead to important savings. Ask a representative to call, or write for the booklet, "Ways to Reduce the Cost of Chips." Address Dept. F-68.

THE INGERSOLL
MILLING MACHINE COMPANY CUTTER DIVISION

ROCKFORD,



#### Now - 649 standard sizes in

#### the bearings with the "built-in" oil supply

For all types
of bearing products
BOST-BRONZ®
Oil-impregnated Bearings
BEAR-N-BRONZ
Solid Bronze Bearings
BALL BEARINGS
Sheaves Wheels
PILLOW BLOCKS
FLANGED CARTRIDGES

your best buy
is nearby

BOST-BRONZ is BOSTON Gear's improved, all-purpose, porous bronze bearing metal. Oil-impregnated, it maintains a constant uniform film of lubrication over the entire bearing surface. You get BOST-BRONZ bearings FROM STOCK, install them and forget them.

YOU SAVE the time and expense of reaming to fit, and of machining oil grooves and oil holes. You end "too

little or too much" oiling by careless operators, and avoid oil drip and contamination or damage of food, textiles, etc.

The BOSTON Gear Catalog lists BOST-BRONZ plain, flanged, and thrust bearings, cored and solids bars, and plate stock in 649 standard stock sizes. Ask your BOSTON Gear Distributor for complete information. Boston Gear Works, 83 Hayward St., Quincy 71, Mass.

CALL YOUR BOSTON

- STANDARDIZATION PAYS -





Adv. copyright by Boston Gear Works



Hydraulic presses should work smoothly, with no jerk or



erratic action. But sludge and varnish in an Eastern plant's presses

caused uneven operation, with
increasing "rejects."



A Sinclair lubrication engineer recommended Sinclair's new DURO hydraulic oils with oxidation, rust and foam inhibitors.



Result: outstanding performance, with "rejects" cut to minimum.

Let Sinclair tackle (and solve)

your plant problems. Call your
local representative or write...



SINCLAIR REFINING COMPANY

TECHNICAL SERVICE DIVISION . 600 FIFTH AVE., NEW YORK 20, N.Y.

# LENOX ANNOUNCES MAJOR BAND SAW BLADE ADVANCEMENT!

The Lenox Master-Band triples the square inches of cutting per blade. Its positive cutting life is guaranteed to be at least three times longer than regular bands. A faster cutting rate is immediately visible. New cutting accomplishments can be made with standard band saw machine equipment SEE COUPON BELOW for Guaranteed Trial Offer.

We are extremely confident of our new Lenox Master-Band. We will guarantee that this advancement in metal cutting band saw blades will definitely put new life and more versatility into your standard band saw machine. The Master-Band will cut at a 50% faster rate than a regular band saw blade. The Master-Band will cut more square inches of metal and we guarantee that it will outlast at least three regular metal cutting bands. In addition, many of the tougher alloy steels which previously could not be cut with a regular band saw blade, can now be cut on your standard equipment with the new Master-Band.

The Lenox Master-Band is a special alloy steel band saw blade designed and engineered especially for use on conventional, horizontal and vertical metal cutting band saw machines such as the Kalamazoo, Johnson, Wells, Doall, Marvel, Grob, Laidlaw, and others.

THE MASTER-BAND IS SUPERIOR! The special steel analysis of this new blade results in a greater quantity of carbides in the structure and when

processed through the Lenox modern,

skillful heat-treating, we produce a band saw blade of proven superiority. The Master-Band assures superior resistance to wear, highly extended fatigue resistance, and assures continuous cutting of tougher steels at faster rates.



The Lenox True-Weld process, which is performed with exceptionally precisioned, fully automatic equipment, guarantees the almost total elimination of weld breakage. Specially designed welding equipment is necessary for welding the Lenox Master-Band. Each blade is perfectly matched and electrically butt welded and inspected to assure integrated bonding. Each weld is precision ground and inspected to prevent hollowing.

COST ADVANTAGES: More pieces can now be cut in the same time period because the Master-Band cuts at a faster rate. Expensive down-time for at least three blade changes can now be eliminated. Tougher steels that had to be cut by other, more expensive cut-off methods, can now be cut on your standard band saw machine with the Master-Band.



WRITE TODAY FOR MORE INFOR-MATION! Want more information on increasing blade life and decreasing cutting costs? Contact your industrial distributor or write outlining your particular cutting operation. Specify materials and sizes most often cut. Also, indicate the make and model of your band saw machine. Your inquiry will be promptly and carefully answered.

#### GUARANTEED TRIAL OFFER





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	-	-			-	-		-		-						-			r	-	-	e				

SPRINGFIELD, MASSACHUSETTS, U.S.A

PLEASE FURNISH ALL INFORMATION REQUESTED,

COMPANY....(type or print)

eity

ADDRESS (street & no.)

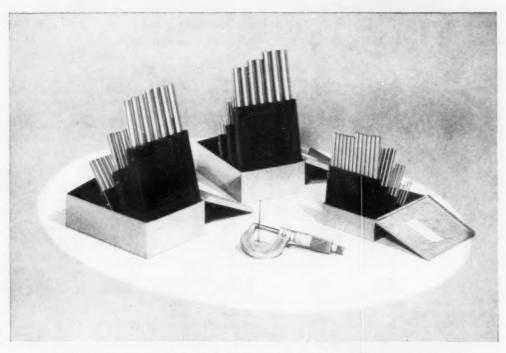
IMPORTANT! PLEASE COMPLETE
MATERIALS AND SIZES CUT MOST.....

#### WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE

SPRINGFIELD, NEW JERSEY

#### **HUTCHINSON HSS BLANKS**



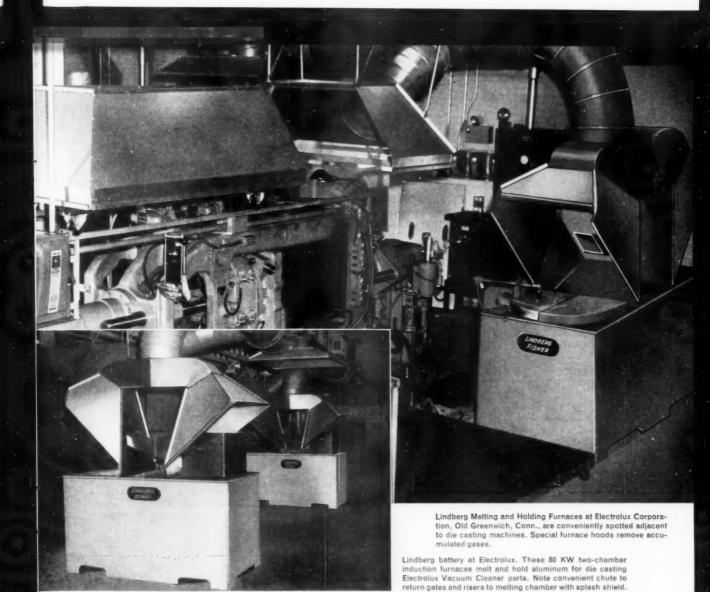
115 Pieces - COMPLETE - .040" to .500" - \$88.00

your choice of two tolerances +.0002" -.0000or +.0000 -.0002"

JOBBER SET LETTER SET WIRE SET \$32.27 \$29.03 \$27.40 in Huot Index in Huot Index in Huot Index

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish — parallel ground.

ANY DECIMAL DIAMETER OF STANDARD LENGTH .010" TO 1.000" SHIPPED ON 24 HOUR NOTICE



#### LINDBERG MELT AND HOLD FURNACES HELP DIE CASTING EFFICIENCY AT ELECTROLUX

Recently, Electrolux Corporation, Old Greenwich, Conn., decided to die cast parts for the famous Electrolux Vacuum Cleaner in their own plant. To insure greatest efficiency and to provide the most ideal layout and working conditions Lindberg Two-Chamber Induction Melting and Holding Furnaces were selected to supply aluminum for the die casting machines. Electrolux has found Lindberg equipment to be completely reliable, ideal casting temperatures are easily maintained and the absence of noise and burner heat assures comfortable clean working areas. Operation has proved so satisfactory that two additional Lindberg furnaces have been purchased and are now being installed.

Wherever or however aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, remelting or heat treating are available in all capacities, electric or fuel fired. See your Lindberg Field Representative (consult your classified phone directory) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Ave., Downey, Calif. In Canada: Birlefco-Lindberg, Ltd., Toronto. Also factories in: Argentina, Australia, England, France, Germany, Italy, Japan, Scotland, South Africa, Spain and Switzerland.





# BATH Tapin Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1

No. 15

#### Subject: Tap Drill Sizes

To avoid tapping difficulties, it is advantageous to keep the minor diameter of the tapped hole as large as possible to utilize the lowest percentage of full thread consistent with adequate strength.

A minor diameter that provides a 55% to 65% thread is sufficient in most tapped hole requirements, but in some specific cases a higher percentage of thread may be necessary.

In most materials and under ideal conditions drills may be expected to cut oversize. In the table at the bottom of the page, the probable percentages of full thread were determined by the average amount oversize the various drills are expected to cut. Reaming becomes necessary when closer control of the hole size is required.

#### SUGGESTED PERCENTAGES OF FULL THREAD IN TAPPED HOLES

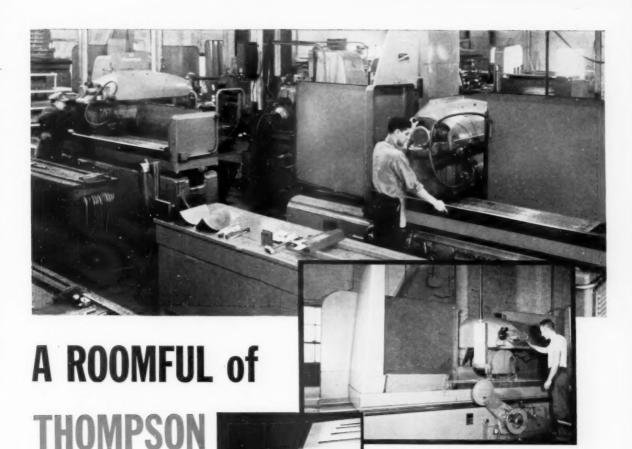
	MATERIAL	DEEP HOLE TAPPING	AVERAGE COMMER- CIAL WORK	THIN SHEET STOCK OR STAMPINGS	A	MATERIAL	DEEP HOLE TAPPING	AVERAGE COMMER- CIAL WORK	THIN SHEET STOCK OR STAMPINGS
Hard or Tough	Cast Steel Drop Forging Monel Metal Nickel Steel Stainless Steel	55%-65%	60%-70%		Free Cutting	Aluminum Brass Bronze Cast Iron Copper Mild Steel Tool Steel	60%-70%	65%-75%	75%-85%

#### PROBABLE PERCENTAGE OF FULL THREAD PRODUCED IN TAPPED HOLE USING STOCK SIZES OF DRILL

TAP	TAP DRILL	PERCENT- AGE OF THREAD	TAP	TAP DRILL	PERCENT- AGE OF THREAD	TAP	TAP DRILL	PERCENT- AGE OF THREAD	TAP	TAP	PERCENT AGE OF THREAD
0-80	56	74	5-44	36	55	12-28	16	77	1/4-14	V	60
	364	71	6-32	37	78		15	70	%-20	W	72
1-64	54	81		36	71		14	66		23/64	65
	53	59		%4	64		13	59		X	55
1-72	53	67		35	63		3%	54	1/2-13	27/44	73
	3/10	50		34	60	1/4-20	9	77		1 %	58
2-56	51	74		33	55		8	73	1/2-20	29%	65
	50	62	6-40	34	75		7	70	%-12	15/52	82
	49	49		33	69		13/4	66		33/64	68
2-64	50	70		32	60		6	65	%-18	3/2	80
	49	56	8-32	29	62		5	63		29/4	58
3-48	48	78		28	51		4	57	56-11	17/12	75
	3/4	70	8-36	29	70	1/4-28	3	72		23/64	62
	47	69		28	57		1/32	59	%-18	%	80
	46	60		%4	57		2	55		37/44	58
	45	56	10-24	27	79	%-18	F	72	34-10	4764	80
3-56	46	69		26	74		G	66		21/22	68
	45	65		25	69		17/4	59	34-16	13/4	71
	44	48		24	64	İ	Н	59	76- 9	4%	72
4-40	-44	74		23	61	%-24	H	78		25/12	61
	43	65		3/2	56		1	67	76-14	51/4	79
	42	51		22	55		3	58		13/6	62
	3/12	50	10-32	3/12	75	36-16	5%	72	1-8	35/4	83
4-48	42	61		22	73		0	68		7/a	73
	1/12	60		21	68		P	59		37/44	64
	41	52		20	64	36-24	23/4	79		39/32	54
5-40	40	76		19	51		Q	71	1-12	29/12	81
	39	71	12-24	11/64	75		R	58		59/4	67
	38	65		17	73	%-14	T	81		13/14	52
	37	58		16	66		23/4	79	1-14	33/4	78
5-44	38	72		15	60		U	70		15/4	61
	37	63		14	56		36	62		1	

«Cylindrical and Thread Gages «Ground Thread Taps «Internal Micrometers John BATH & Co., Inc.

28 Mann Street, Worcester, Mass.



GRINDERS

Jessop precision ground flat stock which is used in gages, dies, verniers and other exacting products.

Pictured above are 4 Thompson Grinders in the Specialties Division of Jessop Steel Company, Washington, Pennsylvania. There are 4 more Thompsons which are not shown in the above photo. All these Thompson machines are grinding to the extremely accurate tolerances and fine RMS

This is the eighth Thompson grinder recently installed at Jessop which grinds plates and sheets up to  $60^{\prime\prime} \times 96^{\prime\prime}$  in size.

finishes that distinguish Jessop's precision ground flat stock.

There are excellent reasons for using 8 Thompsons on this essential production. Mr. Joseph Manfredi, who is responsible for the quality and production of this famous ground flat stock, says, "We have recently installed our eighth Thompson grinder in this division. We have proven the top performance of these rugged machines for many years. They give us the extreme accuracy and precision we demand—day after day with a minimum of maintenance."

You may not need 8 Thompson grinders in your operations but it will pay you well to investigate what just one Thompson machine can do toward saving time, improving your products and cutting your costs of manufacture.

Your inquiries are invited.

#### THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO

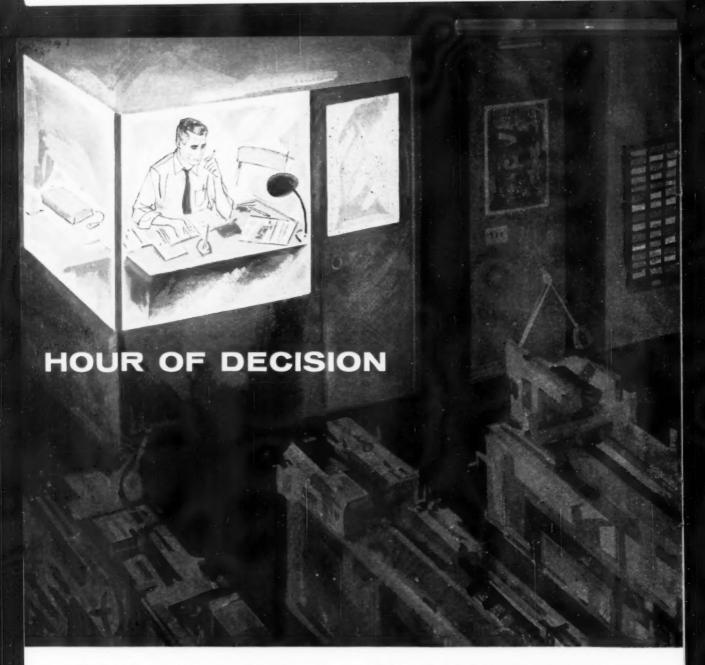
"Keep NOW 10 in mind for that daily grind"

May 1960

Use Reader Service Card. CIRCLE 40

49

GRINDERS



After hours? — sure You're not surprised at that because you know it's when he (and probably you, too) concentrates on the problems which are vital to his company's continued successful growth. The day is filled with production crises, maintenance problems, personnel questions, and committee meetings. It's only now that he can really study the facts and decide what's best.

Right now he's reviewing his machine tool inventory. He's amazed at how old some of his equipment is getting to be. It seems only yesterday that he signed the purchase order for it to increase his capacity for World War II. But that was 1943, seventeen years ago! No wonder maintenance is getting high and efficiency is dropping off.

We've got a suggestion for this man (and for you, too). Attend THE MACHINE TOOL EXPOSITION — 1960 and see for yourself why Modern Machine Tools = Production Efficiency. This exhibit, the first since 1955, is sponsored by The National Machine Tool Builders' Association\* and will contain eleven acres of the U.S.A.'s, newest machine tools under power, cutting and forming metal to demonstrate 1001 ways to lower production costs. Can you afford to stay home?

You're also invited to the PRODUCTION ENGI-NEERING SHOW on the Navy Pier.

No extra registration needed.

\*The N.M.T.B.A. represents 90% of the U.S.A. machine tool industry.

FORMULA FOR TOMORROW



International Amphitheatre Chicago, Illinois Sept. 6-16

#### THE MACHINE TOOL EXPOSITION - 1960

NATIONAL MACHINE TOOL BUILDERS ASSOCIATION

2139 Wisconsin Avenue, N.W. . Washington, D. C.

if

YOU ARE RESPONSIBLE
FOR EMPLOYING NEW IDEAS
FOR FAST, ACCURATE AND ECONOMICAL
PRODUCTION CUT-OFF SAWING

it's important

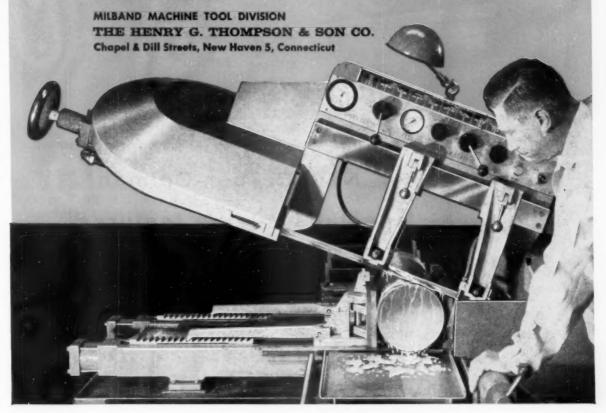
THAT YOU INVESTIGATE . . . AND WITNESS A DEMONSTRATION OF THE ALL-NEW

Milband

#### HORIZONTAL BAND SAW MACHINE

... a machine tool designed and built specifically for maximum efficiency and full blade life, using high speed steel band saw blades. Until you've actually seen this machine in action, you can't fully appreciate its ability to speed your cut-off production sawing and reduce your per-cut costs. Write for illustrated Milband fact folder.

Ask for a demonstration.



# A New Concept in Lathes

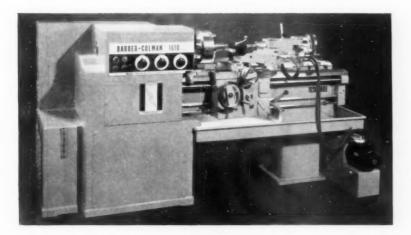


New Barber-Colman

"specialist" lathe features

16" and 20" swing and infinitely

variable feeds and speeds





See the 1610 with tracer at 1960 Machine Tool Exposition . . . Booth No. 923.

Barber-Colman's new 1610 lathe with 16" or 20" swing and 6½ hp motor is a "specialist" lathe for turning, facing, and boring—and there's a place for it in every lathe department. Setup time is reduced, and production is increased 100% or more on many jobs. You might hesitate, at first, before buying a precision lathe that cannot be used for threading. But greater speed and feed control for those who want productivity and precision at a saving produces several practical benefits.

Low initial cost—You can purchase a Barber-Colman 1610 equipped with tracer attachment for approximately the same price as a toolroom lathe of the same rated capacity and quality. If other lathes are available for threading, this lathe is the most economical one to use for high-speed turning, facing, and boring. This lathe is also available as a 1610-13 for high-speed machining of parts which require 20" swing over the ways.

#### Why put low-speed work on a high-speed lathe?

Since threading normally requires slow speeds, older toolroom lathes can be used economically for cutting threads. Put your turning, facing, and boring operations on this lathe to take full advantage of its high speeds (up to 2000 rpm) and infinitely variable feeds and speeds.

Control of feeds and speeds—Spindle speed of this 1610 is instantly, independently, and infinitely variable to any speed in its available range. Even during the cut, the operator can change spindle speeds just by turning a dial on the headstock. No time is lost shifting gears or stopping the machine.

Power feed to both carriage and cross slide is infinitely variable, also. There are no gears to shift—just a simple dial on the headstock. Feed per revolution can be varied from .0001" to .488", depending upon the speed range of the machine.

On high stock removal jobs, you can rough to within a few thousandths of final size, then take a quick finishing cut. The ease with which Class B operators can control feeds and speeds assures finer, more uniform finish, maximum machine utilization, and economical tool life on every job.

Simple tracer setups—Experience proves that less than 20 minutes is needed to set up the Barber-Colman hydraulic tracer. This is possible because the stylus can be positioned independently of the tool slide—the valve responds to pressure from any direction. Front mounting makes it easy to change over—chips don't pile up on the template. The lathe can be operated manually without removing the tracer, or the attachment can

be replaced with the regular compound in less than ten minutes. Tracer operates from 0° to 90° with the work axis, and controls the machine cor stently within .001" on diamet 2 or length.

#### Quality, versatility and economy

Convenient controls—particularly the five-position, turret-type longitudinal feed stop—simplify operation even at peak production efficiency. This feed stop is particularly advantageous for multiple-diameter turning because it eliminates scale readings and reduces skill requirements. It is one of many standard features on the 1610—simple, easy to use, and trouble-free.

Obviously, this is another Barber-Colman quality machine that will turn out toolroom quality work. Phone your Barber-Colman representative or write us for descriptive literature and complete specifications. Ask for Bulletin No. 9061-1.

Barber-Colman Company



53 Loomis Street, Rockford, Illinois

FEATURED IN CONTROL SYSTEMS OF MISSILE PROGRAM!

# New FLOW CONTROL VALVES



Rivett Hydraulic Flow Control Valves are now being introduced to the trade after four years of thorough field testing in advanced applications for both government and industry. These valves may be used as ordinary "meter in," "meter out," or "bleed off" types of compensated flow control valves by keeping the bypass port plugged in the subplate, and piping the "inlet" and "outlet" ports as desired. This usage means excess oil is spilled over a relief valve so pump is always at full horsepower.

On some meter-in circuits, with the "bypass" port piped to tank, the "inlet" and "outlet" can be piped as above, but any excess oil fed to the valve will flow to tank. As long as the fluid motor or cylinder is working at less pressure than system relief valve setting, the Rivett 3port flow control will maintain oil flow to the work as set, the bypass port will flow excess oil to tank at the work pressure, and therefore the pump is using horsepower only at the rate determined by work requirements.

#### FEATURES

1

Knife edge orifice positively assures consistently uniform low flow; and minimizes change of flow when change of fluid temperature occurs.

2

No drain connection required because special pressure balanced Teflon seals are used.

3

Maximum flow capacities up to 125 G.P.M. in  $1\frac{1}{2}$  size are standard.

4

Valves are usable as two port and three port models.

5

Vernier knob has provision for safety lock wiring.

6

Valves are available with return free-flow check.

#### RIVETT, INC.

Dept. TE5. Brighton 35, Boston, Mass.

The Better You Know Hydraulies - The Better You Like



# SAD-ANEW NATURAL DIAMOND GRIT FOR HIGHER GRINDING EFFICIENCY

Announcing

The development of a New diamond grinding material— SND (Selected Natural Diamonds)

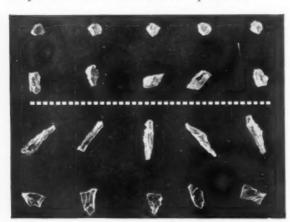
and

# SND — a new natural diamond

# SND—THE LATEST TECHNICAL DEVELOPMENT FOR IMPROVING CARBIDE GRINDING PERFORMANCE

SND (Selected Natural Diamonds) is a *New* natural diamond abrasive developed especially for resinoid bond grinding wheels. It is made up of needle shaped grains and thin, flat platelets selected from diamond boart that has been crushed by a special method.

Diamond particles at least twice as long as they are wide are classified as "needles," and particles that are less than one-quarter as thick as they are wide are classified as "platelets."



Top: Blocky diamond particles predominating in conventional grit.

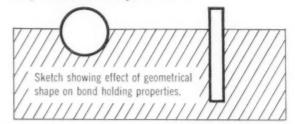
Bottom: Needle and platelet diamond particles predominating in new SND Selected Natural Diamond grit.

#### Conventional natural diamond grit sludge

The absence of large particles in SND—Selected Natural Diamonds sludge shows why SND gives up to 30% longer wheel life and increased wheel efficiency over conventional diamonds.

SND-Selected Natural Diamond grit sludge

#### Why "needles and platelets"?

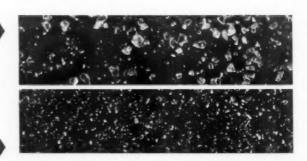


For many years, blocky shaped diamond particles were considered ideal for any type bond grinding wheel. Recent laboratory research into the influence of particle shape on grinding efficiency proved that blocky particles were *not* as efficient in resinoid bond wheels as were thin, flat and needle shapes.

Subsequent tests bore out the important facts that, blocky shapes either wore down level with the matrix, or were pulled out of the bond; while needles and flats seldom pulled out, and instead of wearing smooth, tiny bits broke off in a manner which constantly exposed new, sharp cutting diamond edges to the work.

#### Tests verified by sludge analysis

Analysis of the sludge and swarf collected after tests of both SND and conventional grit wheels verified the test findings. Only uniformly tiny diamond particles were found in residue from SND wheels, proving that each SND particle was almost wholly utilized in the grinding process.



# grit for higher grinding efficiency!

#### How SND (Selected Natural Diamonds) increases grinding efficiency

SND provides more sharp cutting edges per carat in the same grit size.

More cutting edges means a faster, cooler cutting wheel that will last up to one-third longer than resinoid wheels made with conventional grit.

The thin needle and flat grains in SND possess the right amount of natural strength, yet break down easily for fast, free, and continuous cutting.

SND grit offers maximum holding surfaces to the bond, reducing non-productive pull-outs.

SND sharper cutting edges reduce wheel loading and glazing.

#### Proved in laboratory runs . . .

Extensive laboratory runs show SND grit is up to 30% more efficient than conventional grit when grinding cemented carbide at .0005" to .0015" in-feeds and speeds of 5500 S.F.M.

#### Proved in the field

Many metalworking plants now are proving the new SND grit in their own shops with results that substantiate the already-completed laboratory evaluations.

## TREATED SND—ANOTHER NEW GRIT DEVELOPMENT!

A process for treating SND (Selected Natural Diamonds) grit to make it even more friable and to give it superior bonding properties in resinoid wheels also has been developed. This process introduces surface irregularities in the otherwise smooth planes of the SND

particles; these tiny cracks and crevices promote faster breakdown after wear and stronger bonding. Already proved to be more efficient than conventional grit at feeds of .0005" to .0015", on carbide, Treated SND is recommended only for lighter feeds, and where the nature of the work demands rapid grit particle breakdown.

#### The selection is yours . . .

SND grit—for tough applications.

SND Treated grit—for light feeds and coolest cutting.

Conventional grit—for heavy feeds (.003" and up) and the recommended material for metal or vitrified bond wheels.

#### Available now

Your diamond wheel supplier can now furnish you with grinding wheels made with the new SND grit—either treated or untreated—ask him about SND today!

#### Diamond experience

Ready to discuss your diamond problems are Industrial Diamond Division Field Engineers located in key metal-working centers. These are technical men with natural diamond backgrounds and experience. Field offices are in Boston, Chicago, Cleveland, Detroit, Los Angeles, Newark, New York and Philadelphia.

#### **Technical information service**

A new and complete technical information service to help keep you abreast of the latest developments in industrial diamond technology has been established. Monthly Diamond Data and Technical Bulletins will be sent you without obligation. Simply send us your name, title and company address.

#### INDUSTRIAL DIAMOND DIV.

ENGELHARD HANOVIA INCORPORATED

113 ASTOR STREET

NEWARK 2, N. J.



#### Handiest Tool in The Shop

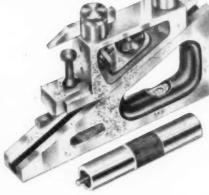
#### STARRETT No. 995 UNIVERSAL PRECISION GAGE

Typical of the wide utility and true economy of Starrett tools is the No. 995. Universal Precision Gage. It can be used as shown as a surface gage, or height gage, base for a Last Word dial indicator, adjustable parallel, transfer gage, planer or shaper gage and a dozen other uses inspectors, toolmakers and machinists can readily imagine.

It features a fine adjustment for accurate slide setting; form ground combination flat and "V" ways to eliminate side play; flush surfaces to permit use on base, end, top of slide or sides; and an in-built level. Accessories include: scriber and holder,

offset "foot" for reaching into narrow places or below the base line, 1" extension and 3" extension.

Craftsmen prefer Starrett tools like these not only for their unfailing accuracy but because they help them work with greater ease and skill. The whole shop benefits when you make Starrett tools your standard throughout the plant. Your nearby Industrial Supply Distributor carries them in stock. Call him for quality products, dependable service . . . or write for Catalog No. 27 showing the complete line. Address Dept. E, The L. S. Starrett Company, Athol, Mass., U. S. A.



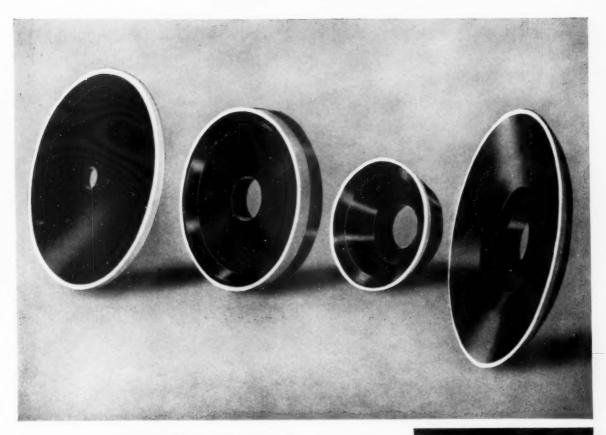
Starrett \*

**PRECISION TOOLS** 



Starrett Precision Makes Good Products Better

PRECISION TOOLS . DIAL INDICATORS . STEEL TAPES . GROUND FLAT STOCK . HACKSAWS . HOLE SAWS . BAND SAWS . BAND KNIVES



# MANHATTAN DIAMOND WHEELS

#### Cut Cool and Free-Last Longer

Manhattan Diamond Wheels are engineered to give you faster, cooler cutting and longer life.

Advancements in Diamond Wheel construction and NEW RESINOID BOND developments fully utilize the advantages of both man-made and natural diamond insuring top performance from all Manhattan Diamond Wheels.

TRY Manhattan Diamond Wheels on your toughest application—find out for yourself how they perform in your plant—under your conditions—on your operation.

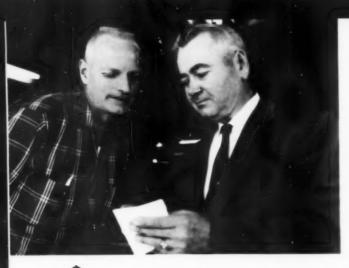
- · New Bonds
- · Longer Life
- Bonded for Specific Grinding
   Requirements
- Natural or
   Man-made Diamonds
  - "MORE USE PER DOLLAR"

BHIOR

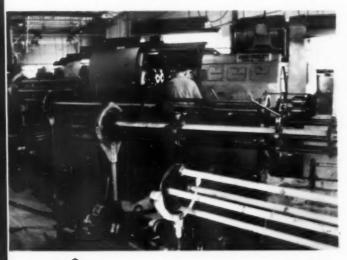
ENGINEERED RUBBER PRODUCTS ..."MORE USE PER DOLLAR"



MANHATTAN RUBBER DIVISION—PASSAIC, N.J. RAYBESTOS-MANHATTAN, INC.

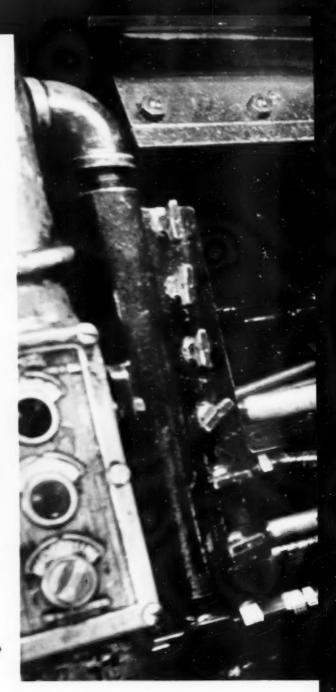


Irving Hunt, left, Secretary of Holt Products Company, and H. F. ("Herm") Johnson, Gulf Sales Engineer, discuss savings resulting from use of Gulfcut 31C.



Section of the modern automatic screw machine department at Holt Products Company, Holt, Michigan. Machining small precision parts, Holt gets superior results with Gulfcut 31C.

Job pictured here: cutting spacer blocks for plow manufacturer. Material:  $1\frac{1}{6}$ " bar stock steel. Tolerances:  $\pm .0005$ ". Feed: .0006 ipr. Production: 340 spacer blocks per hour. Tool grinding required only once a shift. Finish: excellent.



#### Replaces 6 oils with Gulfcut 31C, cuts machining costs 15%...

## **GULF MAKES THINGS**

Three years ago, Holt Products Company, Holt, Michigan, producer of precision industrial, automotive and agricultural parts, was using six different cutting oils in automatic screw machine and turret lathe work. Here was a chaotic and costly inventory problem which Holt Secretary Irving Hunt was eager to eliminate.

Acting on a Gulf Engineer's recommendations, Holt switched to just one cutting oil for all requirements. That one is Gulfcut 31C, a sulfurized mineral-lard oil

possessing heavy load-carrying and anti-weld properties. Today, Mr. Hunt says, "Not only are we saving money by standardizing on this one superior cutting oil, but we are producing better work than ever, with few rejects. The increase in production and the longer life of our high-speed tools have meant a saving of at least 15% in over-all machining costs."

Perhaps some of your inventory and machining problems can be solved by one or more of the outstanding



## RUN BETTER!

oils in the complete Gulfcut line. See for yourself how Gulf makes things run better! Just call a Gulf Sales Engineer at your nearest Gulf office. Meanwhile, send for your free copy of "Metal Machining with Cutting Fluids," the new 116-page handbook on their selection and use.



#### **GULF OIL CORPORATION**

Department DM, Gulf Building Pittsburgh 30, Pennsylvania



SP-9785



# Why use High Torque **UNBRAKO** socket set screws?

#### Up to 40% higher torque and knurled cup point

Simply set them and forget them—that's all you'do with High Torque UNBRAKO socket set screws with knurled cup point. They won't vibrate loose. They're on to stay. Costly downtime and repairs due to set screw failure need no longer plague you. Your assemblies operate at full efficiency... full time.

The tighter a screw is wrenched, the greater its holding power. With High Torque UNBRAKO, tightening torques are as much as 40% higher than for ordinary set screws. Here's how we do it:

- Deeper sockets for maximum key engagement and wrenching power
- Radius socket corners to eliminate sharp angles where cracks start during tightening
- Fully formed threads with metal compressed into a closely knit grain structure and no straight lines along which shear can occur
- Precision heat treated steel to eliminate brittleness or decarburization



And to keep High Torque Unbrako permanently locked, we knurl the cup point. Laboratory tests have conclusively proved that the High Torque set screw with knurled cup point has six times the vibration resistance of plain cup or specialty points.

The myth of back-out torque—Research has also revealed that back-out torque is no indication of a set screw's resistance to loosening in vibration. Tests comparing knurled cup point High Torque UNBRAKO with the specialty point set screw of a leading competitor showed no significant differences in back-out torque between the two products. Yet in impact-induced vibration tests, the High Torque had a vibration life six times as great as that of the specialty point screw.

High Torque UNBRAKO socket set screws are available for any application in sizes #0 through 1 in., in alloy and stainless steels, and with Nylok. Your authorized industrial distributor has a complete supply always on hand. For further information, talk with him or write SPS—manufacturer of precision threaded industrial fasteners and allied products in many metals. "T.M. Reg. U.S. Pat. Of., The Nylok Corporation

#### INDUSTRIAL FASTENER Division

JENKINTOWN 37, PENNSYLVANIA

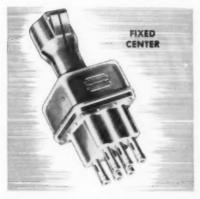
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where reliability replaces probability



# RUGGED to full tool capacity!

...FOR LONG WORKING LIFE
TO ELIMINATE DOWNTIME & PRODUCTION LOSSES!





**THOMSON** 

# THRIFTMASTER

DRILLHEADS





REAM . BORE

COUNTER-SINK

Tremendous economies from the use of multiple-spindle drill-heads are obvious. Use *THOMSON* THRIFTMASTER Drill-heads for optimum performance and profits. *Ask NOW for our new catalog*.



1012 NORTH PLUM ST. LANCASTER, PENNA. EXpress 2-2101

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

Subsidiary of THOMSON INDUSTRIES, INC.

, INC.
makers of BALL BUSHINGS • NYLINERS • 60 Case Shafting

# SIMONDS ALL-NEW HIGH SPEED STEEL METAL This ALL-NEW SUPER HIGH SPEED STEEL Band Saw Blade comes welded-to-length . ready to use . . . in striking, new BAND SAW package with cutting edges protected by a special plastic cover. PERFORMANCE GUARANTEED! up to 3 times better than ordinary blades

The biggest advance ever in metal cutting band saw blades—that's Simonds SUPER High Speed Steel Metal Band Saw. No matter what ferrous metal you're band sawing, this brand new blade will give you up to 3 times better performance than any High Speed Steel blade you're now using!

This is not just a claim but a provable fact backed by Simonds' established reputation as a leading manufacturer of industrial cutting tools.

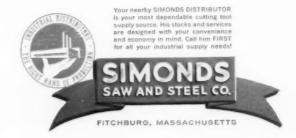
This SUPER High Speed Steel Band is an entirely new concept in band saws . . . new steel\*, new manufacturing methods, new heat treatment, new welding techniques, new final inspection.

Laboratory and field tests demonstrate that this new saw is so much better in every way for production cut-off work that we are offering it on a PERFORMANCE GUARANTEED basis! You can't lose — you can cut your blade costs, save on down time, get the equivalent

Developed and made in Simonds own Steel Mill - Patent Applied For

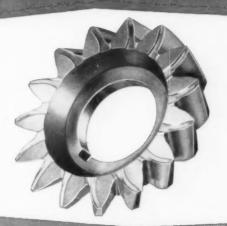
of up to 3 saws in better performance at a cost of only 10% more than ordinary High Speed Steel blades.

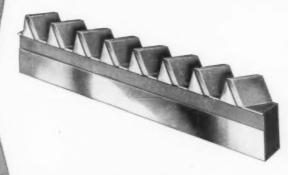
The sooner you try this new blade, the more you'll save! Get prompt delivery now of Simonds SUPER High Speed Steel Band through your Simonds Industrial Supply Distributor or your nearest Simonds Branch.



Factory Branches in Boston, Chicago, Shreveport, La., San Francisco and Portland, Oregon • Canadian Factory in Montreal, Que. • Simonds Divisions: Simonds Steel Mill, Lockport, New York; Heller Tool Co., Newcomerstown, Ohio; Simonds Abrasive Co., Philadelphia, Pa. and Arvida, Que., Canada

National Tool Company
makes rotary herringbone
gear shaper cutters





But did you know we make rack-type herringbone gear shaper cutters

and more special cutting tools of all kinds than any other tool manufacturer?

For more than half a century National Tool Company has supplied high quality precision cutting tools to the metal working industry. When your job requires special cutting tools cell your National Tool representative. His assistance is yours for the asking whether you're interested in one special tool or a complete tooling program.



Representatives in major industrial centers

#### New FREE Catalog

To National Tool Co., 11200 Madison Ave., Cleveland, Ohio

Please send NEW 92 page catalog showing National Tool Company's complete line of special tools for the metal-working industry.

Name\_

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Use Reader Service Card, CIRCLE 52

With a



LK

You can do ....

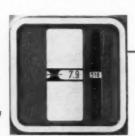
Jig Boring ...
Jig Grinding

by a simple change of heads

on the same

**BASIC MACHINE** 

Numerical Readings to 0.0001"

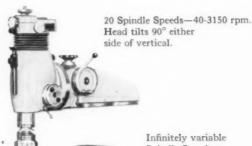


The Deckel LK, with interchangeable heads for optical coordinate jig boring and jig grinding, provides extreme precision with Economy! The heads are easily changed for either operation, and each gives you equally precise performance.

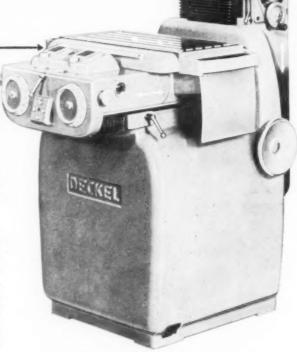
Coordinate worktable settings are read directly, in numerals, to ten thousandths — 0.0001". Reading or setting errors are practically impossible! Actual table positioning accuracy is 0.00012", with longitudinal, vertical and transverse quick-traverse.

To protect the inherent accuracy of the Deckel LK, a thermal expansion compensating device is built into the column. Further protection is provided by heat dissipation from gear box and motor.

Write today for information



Infinitely variable Spindle Speeds— 15,000-60,000 rpm. Head tilts 45° either side of vertical.

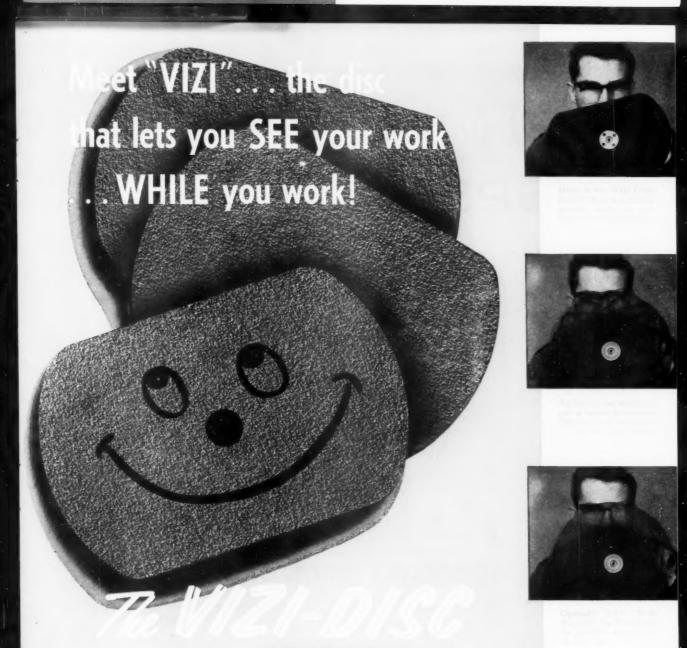


Deckel LK has a worktable clamping area of 25½" x 11¾" and a range of coordinate readings of 15¾" x 10".

COSA

Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA—COSA CORPORATION OF CANADA, LTD., 1160 Lake Shore Road, Long Branch, Toronto 14, Ont.



#### PAT. PENDING

This is what everyone is talking about. The new METALITE VIZI-DISC lets you see the exact area where the work is being done. Its unique shape gives it "see through" like a blade of an electric fan or an airplane propeller. This amazing new disc actually cools itself while it's cutting. And, because there is no blind spot, you grind only the area that needs to be smoothed, thus increasing disc life. VIZI-PADS to back-up the VIZI-DISC are available. They have a herringbone non-skid face that grips the abrasive disc, and guarantees an aggressive rate-of-cut. You can get a free demonstration from a Behr-Manning representative or write Dept. TE-5.

#### BEHR-MANNING CO.

A DIVISION OF NORTON COMPANY

BEHR MANNING PRODUCTS: Coated Abrasives - Sharpening Stones - Pressure Sensitive Tapes - Floor Maintenance Products
NORTOM PRODUCTS: Abrasives - Grinding Wheels - Machine Tools - Retractories - Electro Chemicals
In Canada: Behr Manning (Canada) Ltd., Brantland. - For Export: Norton International Inc., Troy, New York, U. S. A.



# No coil burnout with

## SPEED KING®



#### ...pilot operated control valves

- Built to JIC standards interchangeable pilots
- $\bullet$  choice of mounting types, optional features  $\bullet$  ac or dc, any voltage  $\bullet$   $\ ^{1}\!\!/_{2}$  to 1 in. NPT

SPEED KING solenoid pilot coils, potted in molded resin, are unconditionally guaranteed against coil burnout for the life of the valve! And, Speed King pilots are totally enclosed, and sealed against entrance of dirt or moisture . . . valves are fully air-operated for speed and dependability . . . feature a hard-chrome plated stainless steel plunger floating in O-rings, to eliminate wear-producing metal-to-metal contact.

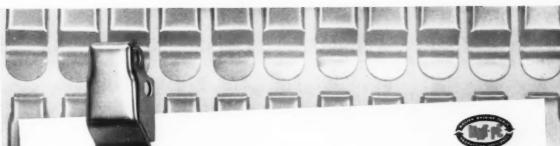
For multi-million cycle dependability, specify Valvair® SPEED KING control valves.

Write for free Bulletin SK-100. Address: Valvair Corp., Akron 9, Ohio, Dept. TE-560



8111

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## WEILAND TOOL AND MANUFACTURING CO. GETS 5% MORE PARTS PE

WITH PRECISION DANLY 4-POST DIE SET



Latch handles are stamped out in this 7-station progressive die mounted in a precision Danly 4-post die set.

In mid-'59 Weiland Tool and Manufacturing Company of Chicago replaced a worn, 7-station, progressive die to continue production of a standard latch part. The new die was built to identical specifications, except that it was mounted in a 4-post precision Danly die set instead of a 2-post set as previously used.

The number of pieces per die grind produced on the new die far exceeds the output from the earlier identical die. Weiland Tool estimates that, conservatively, 25% longer die life is directly attributable to the extra precision and alignment of the Danly 4-post die set.

Benefits from this longer die life are not limited to a lower per part cost of dies. In addition, Weiland Tool is avoiding considerable downtime for die sharpening and set up, and they are freeing diemakers and set-up men from unnecessary maintenance activities.

Here is proof that the finest die set obtainable, is the lowest cost insurance for your expensive dies. May we show you how Danly die set precision can save money for you. Write for the informative folder "The Importance of Die Set Precision."



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DANLY MACHINE SPECIALTIES, INC. / 2100 SOUTH

#### SUNDSTRAND "Engineered Production" METHODS

# ... practical ideas for men who are responsible for manufacturing quality, quantity, and profit

#### BROACHING

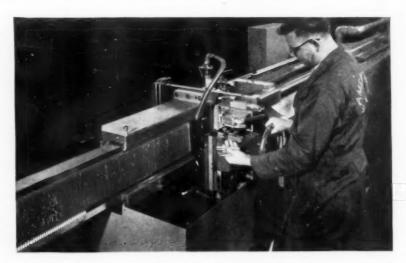
Wide range of straight and taper keys produced better and faster on a single Sundstrand-American broaching machine with universal fixture.

Over 25% production increase, better finish, and greater accuracy were achieved by installation of this Sundstrand-American horizontal broaching machine to replace equipment previously used.

Parts are keys ranging from ½" to %" wide, and from 1" to 6" in length in both straight and taper types. They are machined complete in one operation from bar stock. A single broaching tool is used for the complete range of parts produced. An easily adjustable universal fixture compensates for the length, width, and taper of the keys.

This basically standard machine with its special fixturing and tooling is a typical Sundstrand "Engineered Production" answer to a specific production machining requirement.

Because Sundstrand manufactures an extremely broad range of machine



tools, including for example, broaching and milling machines, Sundstrand engineers have no fixations about the ideal method of performing the job. They approach each application with an open mind, a broad background of experience, and a wide range of "building-block" machines to draw from. This enables them to develop the best answer from the

standpoint of production rate and cost, as well as the long-range economics of the machine — including future machining requirements.

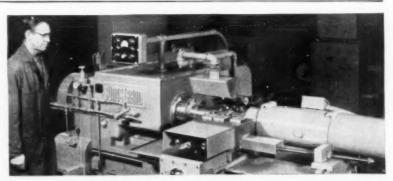
For complete information on Sundstrand-American broaching machines, write for literature or, better yet, outline your specific requirements for preliminary recommendations on the machine to handle them.

#### **AUTOMATIC TURNING**

50% production increase achieved with multiple tooling on Sundstrand automatic lathe.

In nearly every shop, there are jobs on which the combination of automatic cycling and multiple tooling provided by Sundstrand automatic lathes will markedly reduce machining time and cost — for short as well as long runs. The machine cycles are so quickly changed over that setting up for a short run is entirely practical.

On the Model 12A machine illustrated, cylinder liners are turned, faced, grooved, and chamfered in just about half the time formerly required. This machine and its tooling are the result of a Sundstrand "Engineered Production" analysis wherein present and future work re-



quirements were evaluated along with tooling requirements and cost. Standard Sundstrand automatic lathes have been designed to provide maximum machining economy for an extremely wide range of operations. Where production volume warrants, Sundstrand recommends and builds semi-standard or special ma-

chines, as well as automatic workhandling devices and various standard or special attachments to exactly meet requirements.

For descriptive literature, write stating the size of lathe in which you are interested, or briefly describe the size and type of workpiece and machining requirements.

#### THREAD MILLING

Two operations performed simultaneously with one chucking on Sundstrand-Hanson-Whitney machine.

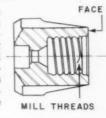
Cost of one complete machining operation has been eliminated by performing it simultaneously with another on this thread milling machine.

The part is a rock bit which must be accurately machined to seat properly on the drill "steel" which is used to drive it. The face (see illustration) must be square with pitch diameter of the thread within .003".

Milling of the thread is a standard operation. The addition of a vertical milling spindle provides simultaneous facing within the required tolerance limits. Production rate (100%) is 60 parts per hour.

The machine illustrated is typical of the complete line of Sundstrand Hanson-Whitney semi-automatic thread milling machines in sizes from 4 x 9" to 15 x 30", with bed lengths ranging from 33 to 84 inches. The advantages of thread milling are numerous, including:

- Will produce thread pitches too coarse for practical die cutting.
- Faster and more efficient than single-point cutter and conventional lathe, disc-type cutter and conventional thread miller, or conventional single-wheel grinding.
- Smoother and more accurate threads than usually obtainable with tap or die.
- Provides threads with pitch diameters bearing definite and accurate relationships to other elements of the workpiece.



These machines also permit convoluting of the first thread automati-



cally, produce threads in locations impossible or impractical to reach through use of lathe, tap, or die, and hold tolerances on repetitive parts much easier than they can be held on a lathe.

For complete information, ask for Sundstrand Bulletin No. TM715.

#### ROTARY MILLING

Ruff and finish milling performed on single Sundstrand Rigidmil faster and more accurately than by previous method.

Many production milling problems can be simplified and improved through use of Sundstrand single or multiple vertical spindle rotary table Rigidmils.

The job illustrated is a good example. Various sizes and types of cast iron pillow blocks and housings are machined on the two-spindle machine shown, the first cutter performing the ruffing operation, and the second cutter the finishing operation. The rotary table design permits the operator to load and unload without interrupting continuous production.

Easily adjustable fixturing, an integral part of the machine, accommodates a wide range of parts which are produced at a rate of 80 to 240 per hour, depending on size and type.

Not only has production been increased over the previous method machining, but parts quality has been measurably improved through better finish and flatness. High accuracy is an integral function of the precision construction and rigidity of the machine and the Sundstrandengineering fixturing.

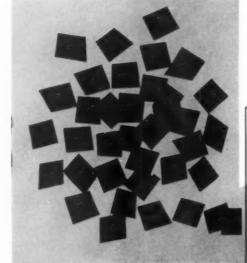
Sundstrand manufactures a complete line of standard rotary milling machines which can be provided with standard or magnetic chuck tables, as well as fixturing designed simplify holding and load and unload of virtually any type of part, regardless of irregularity.

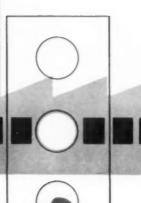


For data and specifications, ask for Bulletin No. VR715.

# SUNDSTRAND MACHINE TOOL BELVIDERE, ILLINOIS - DIVISION OF SUNDSTRAND CORPORATION Automatic and Milling Transfer Multiple-celedia Belt and Broaching Broaching Throad Milling

Les Compagnes de la compagnes







TE-1

# Are you working toward automatic machine tool control?

The means by which instructions are reduced to the language of machinery and conveyed as intelligible orders to that machinery comprises the system complex which makes automatic control possible.

For many years North Electric has been designing, engineering and manufacturing such system complexes, over 5,000 of which are in operation today!

The selection and application of components, a thorough understanding of advanced switching techniques and complete familiarity with complex circuitry design are but three of the many highly specialized areas demanding unique capabilities and which are frought with danger for the uninitiated. This is the professional climate in which the experienced, system-concept-minded engineering group at North Electric works constantly and continuously!

If you are working toward automatic control of machine tools and automation of production machinery, you cannot help but profit when you call on the most experienced system group available.

If these are your goals—you'll want NORTH on your team. Write, wire or phone for an appointment to learn how much North can do for you.

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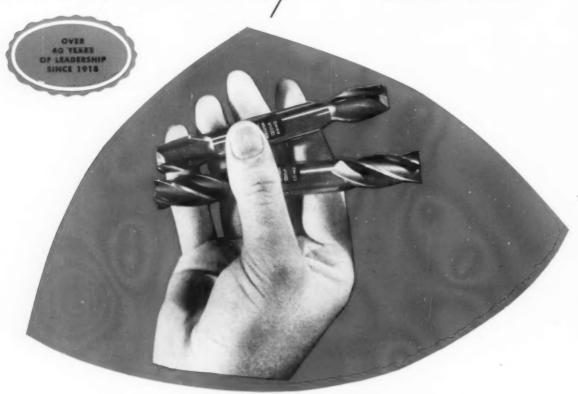
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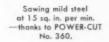
For all of these years we have consistently led the field in the origination and production of the highest quality end mills, holders and allied items.

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Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.



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POWER-CUT® NO. 360—a blend of mineral oil and sulphurized animal fat with high anti-weld characteristics; water-soluble to give added capacity for heat removal, higher machining rates, faster chip removal.

KLEEN-KOOL®—a non-oily solution for superior surface grinding; leaves a dry, microscopic film which eliminates the need for subsequent washing; doesn't gum or glaze grinding wheels.

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#### **ASTME Active**

This is my last appearance on this page. In a way, it is the formalized culmination of 12 years as a chapter and national officer.

These 12 years have endowed me, I hope, with the knowledge and experience to say with some authority that the ASTME's future is in good hands.

The knowledge, Society experience and dedication so evident throughout the Board of Directors, the officer group, the National Family and Headquarters staff, assure a vigorous and prosperous future for ASTME.

Just as important are the daily accomplishments of thousands of progressive members. Individual participation is on the rise, by a considerable percentage, among the membership. These men will continue to offer the many contributions of time, effort and talent so necessary to effect our purpose, which is the dissemination of technical data and methods,

A little over a year ago the Long Range Planning Committee was formed to study the future course of the Society. Several meetings have developed many conclusions, and certainly have equipped the Board and officers to chart the proper route for

I am proud of my role in some of the year's accomplishments. I think of the chartering of nine new senior and eight student chapters in this country and Canada; of the first Suppliers Directory and its gratifying user acceptance; of the monumental revision of the Tool Engineers Handbook, and notably the spiraling contributions of individuals and chapters to the Society's books programs; and, lastly, of the addition to the Society's name. To my mind, this is the greatest single improvement in 15 years; here we have not only honored those manufacturing engineers who have become a part of our growth, we have merged their name.

I can honestly say that every member I have met has been interested in Society growth and achievement. The support of all, including many who are not members of the Society, has been most enlightening and appreciated.

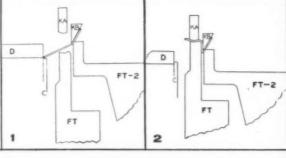
You have honored me with a life membership, and in return I pledge my unfailing faith and promise to remain active in ASTME.

Maque Ev

American Society of Tool and Manufacturing Engineers

#### KEY

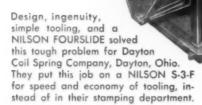
- KA King Post Tool
- KB King Post Tool Inserted
- FT Front Slide Tool
- FT2 Front Slide Tool #2
- RT Right Slide Tool
- LT Left Slide Tool
- BT Back Slide Tool
  C Cut-Off
- D Cut-Off Die



# JOB SHOP MAKES COMPLEX PIECE IN ONE OPERATION

on a NILSON S-3-F FOURSLIDE

with its built-in 20 TON PRESS



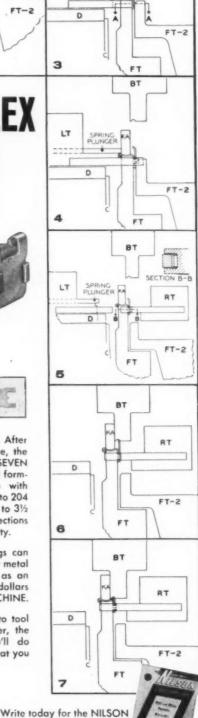
They benefited first by getting into production faster than possible with complicated cams and progressive dies necessary to do the same job. Second, even though the part is complex, the FOURSLIDE tooling is simple and comparatively inexpensive. Third, the entire piece is formed completely in one machine, resulting in equipment and manpower savings.

The built-in 20 Ton Press produces blanks, from .025" x 1.125" cold rolled ribbon steel, which are continuously fed into the FOURSLIDE tooling area, where the first blank is cut off from the one

following. (See Tooling Step #1). After the 6 additional steps shown here, the piece is completed and ejected. SEVEN MODELS of NILSON ribbon metal forming FOURSLIDES are available with ribbon speed ranges between 32 to 204 parts per minute, stock widths up to 3½ inches, and with built-in press sections ranging from 5 to 75 tons capacity.

Many of these production savings can be yours when you consider every metal stamping and wire forming job as an opportunity to save time and dollars with a NILSON FOURSLIDE MACHINE.

Remember — it's usually simpler to tool a FOURSLIDE, it's certainly faster, the economy is startling, and you'll do stamping jobs in one operation that you didn't think could be done.





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FOURSLIDE Catalog No. 62

# the future of AUTOMATION

By Carl F. Stugard

Manager Special Machine Div. The Cincinnati Milling Machine Co. Cincinnati, Ohio

Physical and mental drudgery will be a thing of the past in the plants of the future, where versatile machine tools, numerical control and computers will all contribute to greater productivity.

This is an age of tremendous engineering accomplishment. Today few people seriously doubt that man can land on the moon or even inhabit space in a few more years. The time between conceiving an idea and making it a reality has been greatly shortened and it is possible to predict future trends on the basis of today's accomplishments.

In the field of metalworking, for example, there has been a steady drop in the number of man-hours required to produce a given part. Since 1930, developments in many types of machine tools have

enabled any company taking full advantage of them to double productivity every 10 years.

Automation is responsible for a good proportion of this increase in production per man-hour. At first automation was restricted to fixed-program machine tools, such as screw machines. The next step was the development of batteries of fixed-program machine tools—transfer machines. Now numerical control has made variable-program machines a reality.

Despite these advances, automation in metal-working still has a long way to go. The day of the "automatic factory" has not yet arrived and—for sound economic reasons—it may never arrive. Automatic factories can be—and have been—built, but total automation can only be justified where products like safety pins or machine screws are needed in unending profusion. This is true whether the automatic factory is a single short production line or an industrial complex that handles a job from the initial order to the shipping dock.

Many of today's manufacturing concepts will have to change because of the American consumer's desire for individuality in manufactured goods. In 1950, for example, most people wanted automobiles just like the ones being driven by their neighbors. By 1959, a considerable proportion of those same people had decided that the automobile they wanted was different from those being driven by their neighbors.

Present-day automation is satisfactory when it

Abstracted from Paper 284, "What Is the Future of Automation and Numerical Control?" presented at the 28th ASTME Annual Meeting.

#### NEED FOR CUSTOM PRODUCTS

#### NEED FOR MORE PRODUCTS

NEED FOR REDUCED COSTS

**NEW PRODUCTS** 



Many pressures are changing the face of metalworking.

deals with making a single part design or a closely related family of part designs, but questions such as: "How can you build an automatic line that makes transmission units this week and engines next week?" cannot yet be answered. And answers to basic questions of this kind will be needed before automatic plants can be developed.

One of the solutions is to stop equipping metal-working plants in bits and pieces. In the chemical processing industry entire plants are designed and built as complete production systems by companies that specialize in this field of engineering. These companies furnish complete operating plants to their customers. A number of machine tool builders have designed, built and installed complete manufacturing lines, but certainly the concept of single responsibility for developing production systems is not typical in metalworking. It represents, nevertheless, one of the great opportunities for metalworking progress.

#### Pressures for Change

The need for single responsibility in constructing and equipping plants is one result of the many pressures that are changing the face of metalworking. The first of these pressures is for more mass-produced goods. Present and future population growth and a rising standard of living contribute to this pressure. Industry is turning to automation as the only means of satisfying the requirements of the future for more goods.

This trend would seem to lead to a need for specialized, single-purpose machine tools such as transfer machines. But there is also the counterpressure for individualized products. A manufacturing plant for such products requires general-purpose, highly versatile machines.

Another pressure comes from new products. To-

day internal combustion engines are most widely used. Tomorrow engine plants may be manufacturing gas turbines or free-piston engines or a totally new type of engine that has only two or three moving parts. These simplified designs will have profound effects on metalworking processes.

Still another pressure is caused by new metalworking techniques. The primary job of machine tool builders is to find a better way to cut shapes and form metal, whether by machine tools as we know them today or by tools as yet unborn. Few people believe that metalcutting will ever become obsolete, but it may be depended on for relatively less work in the future than is the case today. There are many alternatives.

Some engineers feel that it makes better sense to build metal up to a finished shape than it does to cut it down to size. While there has been much discussion about moving metal rather than removing it, other possibilities—casting, pressing from powder, or vaporizing shapes with an electric spark or ion beam—should not be forgotten.

Some of the metalworking equipment of the future is certain to combine a number of these processes in one package. There is no reason why a transfer line cannot include forming and finishing—as well as metalcutting—stations.

Despite the fact that new manufacturing methods are being developed, some engineers feel that within 15 or 20 years fewer methods will be employed than is the case today. The lines between such manufacturing methods as milling and drilling, or between turning and planing, are becoming less distinct.

Workpiece materials are also changing the face of metalworking, "Superhard" alloys are a case in point. Machining methods must change so that these high-strength materials can be cut economically. Strong inorganic plastics may replace metals for many applications and these will require new manufacturing techniques.

Economic pressures are usually thought of as the greatest pressures of all, although they probably act as triggers, rather than as basic causes, of many changes in metalworking. It is easy to imagine, for instance, that economic pressures caused automation to be adopted in one of the new bearing plants in this country. As a matter of fact, early cost studies were not conclusive. But the plant was built (incidentally it cost 30 percent more than the original estimate) and it is making bearings 15 percent cheaper than they have ever been made before.

Perhaps the lesson here is that better use can be made of present methods of cost analysis. Another lesson, certainly, is that if all dreams are tied to the dollar, nothing will ever be accomplished.

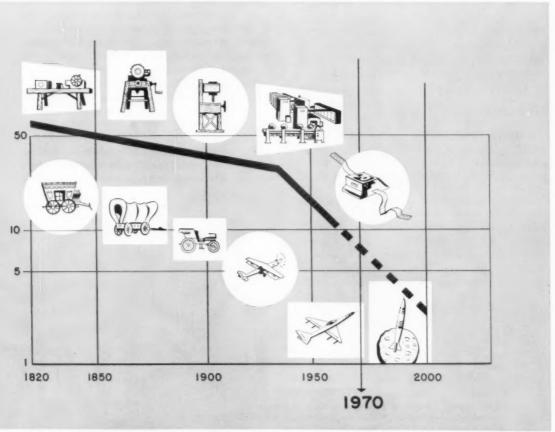
Man, too, exerts pressures on metalworking. Men must be thought of as individuals, as well as in the mass. Engineers should not forget that, ultimately, they are dealing with people, who have feelings and emotions and appetites as well as brains.

#### **Fixed-Program Automation**

All of the pressures that have been discussed will have important effects on the future of automation.

Today automation implies high production. The development of automated systems such as transfer machines has made it technically possible, if not always economically feasible, to achieve any desired production rate. Even slow elements in an automatic production system—bottlenecks—need not slow production, since additional elements can be added until the total output is whatever is required. If downtime prevents the full output of a system to be realized, inventory banks can be added. Feedback elements can be added to make the system self-adjusting and much can be done in the way of automatic maintenance and automatic tool changing.

These are all consequences of the high-production, fixed-program automation used in automotive plants. Such automation is relatively inflexible and subject to obsolescence. In fact the higher the pro-



Since the development of the power feed in 1830, the number of man-hours required to turn out products has dropped substantially. Since 1930, productivity has doubled every 10 years.

duction required, the lower the degree of flexibility and the greater the chance of obsolescence. It is obsolescence, not productivity, that is the limiting factor of fixed-program automation.

Building-block construction is one way of increasing flexibility and slowing down obsolescence. During the next ten years both machine tool builders and users will be working to achieve standardization of equipment without stifling the user's or the builder's ingenuity—the most important factors in manufacturing progress.

There are many opportunities for improvement in the area of work handling. To get the most out of automation, the standardization and further improvement of handling methods is necessary. One way that has been suggested is to categorize parts in classes such as "essentially long and round" (spindle-shaped), "essentially cubic" and so on. How far it is possible to go in developing handling methods for generalized shapes is unknown. There is no doubt, though, that a handling break-through is needed.

This is the sort of problem that operations research is attacking with much success. By studying a process as a whole—and alternative processes—operations research will, in the future, be able to give guidance as to the route selected between raw material and finished product. Operations research will also help to concentrate development efforts in those areas where the largest gains are to be made—a necessity for best results.

#### Selectable-Program Automation

Probably the greatest change that will occur in machining during the next decade is the rise of selectable-program automation to the point where it will play as big a part in manufacturing as fixedprogram automation does today. Numerical control is the means by which this revolution in automation will be accomplished. Hundreds of numerical control systems have already been installed.

Numerical control is not, of course, the only means of attaining selectable-program automation. There have been highly desirable kinds of selectable-program automation for many years. Adjustable stops, cycle selectors and tracer controls on milling machines are examples. The main disadvantage of these systems is that they are not sufficiently flexible or sufficiently automatic.

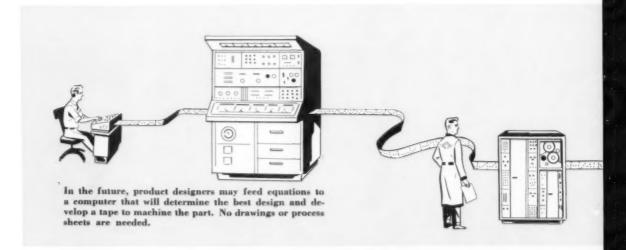
Between the mechanical systems and the more versatile electrical and electronic controls lies a middle ground. Just one example is the peg-board type of control that is being used with considerable success on fixed-bed type horizontal production milling machines. Right now there is a wide choice of selectable-program automation controls, from simple mechanical systems to complex electronic systems. Each of these has its place.

#### Numerical Control

The advantages of numerical control are well-known. Numerical control reduces tooling and shortens lead time. It eliminates errors, both of omission and commission; saves space formerly required for jigs and fixture storage; insures near-perfect repeatability; gives maximum control of the machine to management and so on.

Perhaps the greatest advantage is that numerical control is just as valuable to a small shop as to a big one. In some instances it is practicable to use numerical control to manufacture one part.

In every industry, big or little, where production lots are small, setup time provides a large area for savings. When machining time requires only a few



minutes per part, savings to be made in machining are insignificant compared to the savings that could be made by reducing setup times.

One advantage of numerical control, not always realized, is its ability to reduce inventories. Since one part or only few parts are produced at a time, large inventories of semifinished and finished products are not needed. Thus it appears that numerical control can make it economical to manufacture replacement parts to order—including those that today are typical off-the-shelf items.

Numerical control makes possible a new concept in defense preparedness as well. Strategic materials are stockpiled and some important tooling elements could likewise be stockpiled on tapes or punched cards. In the event of a national emergency, the tapes could be quickly reproduced and transmitted to any number of plants by courier or microwave teletype. The plants could be in simultaneous production in a matter of hours.

This could not be done today to any great extent because of the variety of numerical control systems in use. Some of these systems are not compatible. It is believed by some that the number of systems available will be diminished within the next ten years to perhaps a dozen compatible systems.

Along with the reduction in systems will come some further standardization. Already there has been standardization on input media, with one-inch eight-channel perforated tape now the only type in common use. So far no standard language for coding the tape has been established, although such a standard language has been proposed and some work has been done on it.

A major advantage of automated production systems—numerically controlled and otherwise—is that they provide cost data at their source. Automated machines have electrical outputs that provide information that can be automatically gathered, sorted and converted into cost data. Any company with a computer at its disposal is ready for such an advance in automation.

#### **Automation and Computers**

Computers carry automation into the areas of manufacturing planning, scheduling, product design and management. In manufacturing, computers are commonly used for developing programs for numerically controlled machining, particularly contouring operations. The present trend toward greater simplicity in positioning systems may reduce the need for computers in this field. The large number of positioning machines that will be in use in the near future may justify some form of automatic data handling. In the future, users of numerical control will use computers as freely as they use slide rules and desk calculators today and the cost of computers and computing time will be lowered to make this possible.

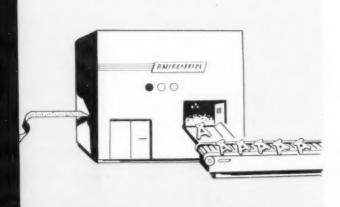
Computers are still new. From 1945 to 1955 they were used almost entirely for working scientific problems. From 1955 to 1960 they were adapted to such functions as payroll and inventory control. At present, they are being applied to process control but many potential applications have not yet been exploited. It is entirely possible that computers will be commonly used by management to make strategy decisions—perhaps as soon as 1965. Computers can, at the very least, make mathematical comparisons between alternatives.

Another application of computers is to product design. Some manufacturers are using computers in this way today, to a limited degree. In designing the lathes and milling machines of the future, engineers may mathematically describe the work the machine is to do, put the description in a computer and let the computer determine the machine design.

Such machines may be radically different from present models. An automated lathe, for example, may look like a refrigerator. An automated lathe doesn't need handwheels or levers; the bed need not necessarily be under the workpiece where it can collect chips; the workpiece need not be at the height of an operator's waist; in fact, the workpiece need not be visible at all.

When products are designed by computer there is no need for drawings. It is already practical to go from the concept of a machine directly into a numerical description of that machine without ever passing through the drawing stage. Looking ahead, it can be seen that the task of design engineers will be to construct formulas and assign them values that can be fed to a computer.

The same principles can be applied to workpiece design. In designing an aircraft hinge, for instance,



requirements such as strength, weight, maximum dimensions, fastening area, center of rotation and the characteristics of several possible materials can be fed into a computer. The computer output is a mathematical description of the hinge, a choice of the best material and a tape prepared for doing the machining.

There is nothing fantastic about this. It is being done today in the aircraft and electrical industries. In a few years it will be routine to design by computer wherever aesthetic considerations are unimportant.

Automation will not be confined to the production bay or the design department. In the future, automation and computers will be applied to communications, eliminating the useless steps in the dissemination of information and the execution of



In the future, manufacturing units—groups of automated machines—will be controlled by a man sitting at a desk and pushing buttons.

ideas. It will be possible to determine trends faster—and respond to them faster—when there are machines to do the mental hack work.

#### **Future Machine Tools**

Machine tool builders are in a position to foresee the needs of industry. During the next few years, their role as advisers and leaders in the metal-working industry will become increasingly important. They are aware of this and are finding dollars in tight budgets for more research. The studies that are under way in hot machining, electrochemical machining and ion-beam machining are typical. Perhaps one of these will become a trend in 1970, much as numerical control is today's trend.

In any event, new metalworking methods will result in new designs for machine tools and there will be internal differences that will not be easy to see. One difference in machine tool design will be increased rigidity. Today's machine tools are designed with a rigidity on the order of one to two million pounds per inch; tomorrow's machine tools may be designed with a rigidity of six million pounds per inch in order to use them properly with numerical controls.

A degree of judgment has been built into some specialized machines—machines that sort parts into categories, for instance, and machines that accept or reject a workpiece depending on what happened to it at some previous station. This principle will be extended as plants utilize a higher degree of automation.

The possibilities inherent in combination machines are especially attractive. Transfer machines in which some stations have fixed programs and others have variable programs controlled by tape can be built today and a good many of them will be seen in the future. These machines may be devoted less to metalcutting than to alternative methods of creating metal shapes. The possibilities of improving the speed of the alternative methods are often better than the possibilities of increasing cutting speeds.

Some new machine tool designs will come about because of new ways of thinking. Controlling the path of a tool, for example, is not the real problem in metalworking. The problem is to achieve a certain shape in a finished part. The required measurements can be transmitted to a gage that can tell the machine what operations are necessary to bring the part to the dimensions called for. This has already been done on grinding operations.

#### Machine Operators and Automation

In the plant of the future, operators will be very important people. It is possible to predict that manufacturing units—groups of automated machines—will be controlled by a man seated at a desk and pushing buttons. The area of responsibility of the operator and the knowledge that he will require will increase many fold.

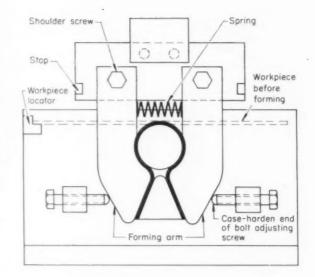
Thus in the future the machine is going to add to the dignity of man. He no longer will be required to do with his hands jobs that a couple of solenoids and hydraulic motors can do better and more efficiently. Instead he will be given jobs that all the marvels of electronics, hydraulics and mechanics cannot do so well.

The first industrial revolution relieved man from physical drudgery. The second industrial revolution is relieving him of mental drudgery. Man will still live by the sweat of his brow but it will be the sweat of thought and dreams.

#### U-Bend and Form Die

Forming of hairpin-shaped parts can be accomplished on the die shown when production volume does not warrant the expense of making cam slides and die blocks. With this design the parts can be cut out on a band saw and filed to finished shape. The forming arms are held apart by a compression spring. As the machine ram descends, the cam action between the adjusting screws and the forming arms pushes the arms together to complete the shape of the part. Adjusting screws are used to set proper part shape at initial setup.

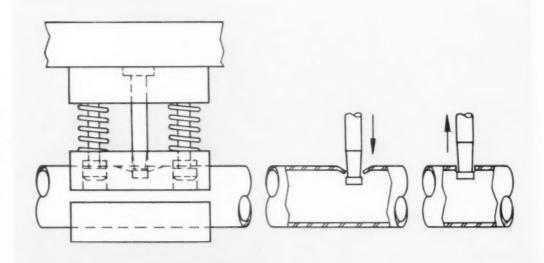
John M. Breen Pittsburgh Chapter



#### **Tubing Punch**

Often when piercing thin tubing, the pressure on the unsupported wall results in depression of the area surrounding the hole. This undesirable effect is eliminated with the gadget illustrated. The tube is held by upper and lower nests, cut to fit the tube shape. The upper nest is spring loaded on shoulder screws. A punch is pushed through the tube wall and as it retracts, a step turned on the shank, catches the edge of the hole and pulls the stock up. The upper rest prevents the metal from being pulled above the tube surface. A slight back taper on the front portion of the punch from the cutting edge to the lifting shoulder is helpful. In general the lifting shoulder need not be very deep. Actual depth depends on the punch diameter and stock thickness.

Ernest Jones Bronx, N. Y.



#### Setscrew Orientator\*

Because of their exterior geometric symmetry, setscrews are difficult to orient for automatic feeding operations. The mechanism illustrated selects and passes through properly oriented screws. In addition, instead of rejecting screws that are not correctly oriented, the device turns these screws so the hex opening is in the right direction.

As shown in the drawing, screws are fed to a rotating wheel through a bushing. The bushing is free to move up and down but is prevented from rotating by a dog-point setscrew inserted part way into a slot in the bushing. The ID of the bushing lines up with the cavity on the wheel permitting a setscrew to enter. If the screw enters correctly the socket falls over the pin and the screw is carried

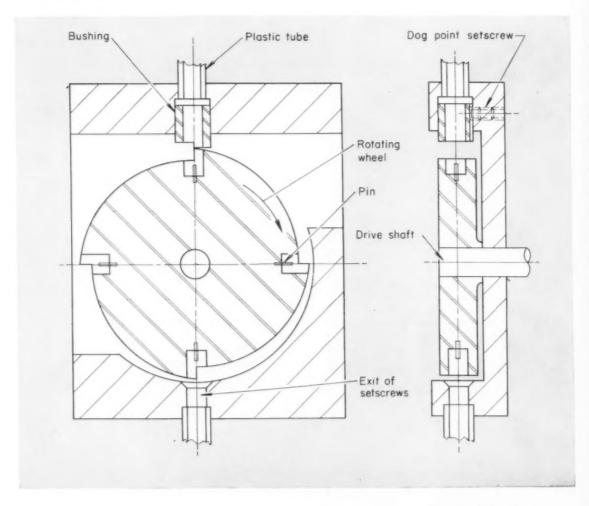
around the wheel to be dropped out at the bottom with the socket up.

If the screw enters with the socket up, the pin in the wheel cavity prevents it from seating below the step in the wheel. The bushing then tips the screw out of the cavity and holds it in position until the next cavity comes along.

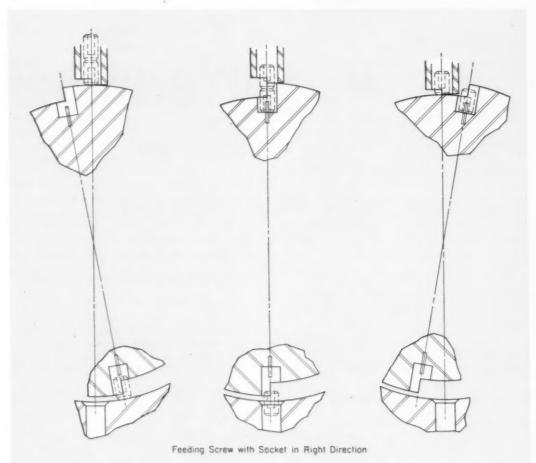
As the next cavity comes into position, weight of the bushing causes the screw to tip into the cavity with the socket down and the screw continues around the wheel to be dropped out at the bottom. The bushing OD must be kept at a minimum to prevent another screw from falling out.

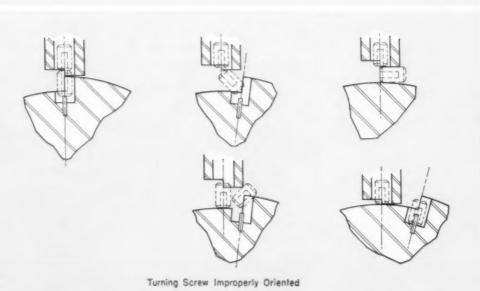
Edward D. Bennett Northern New Jersey Chapter

\*Gadgets Contest Entry



# Gadgets





## Gadgets

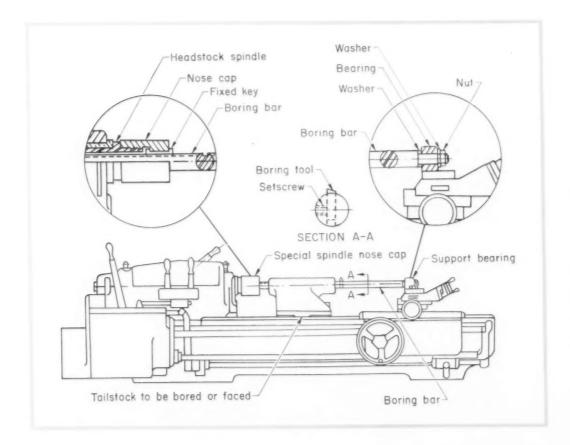
#### Slide Boring Bar

Spindle hole boring of replacement tailstocks and headstocks is accomplished easily and quickly with the boring bar illustrated. The surfaces of the tailstock and its slide are first machined, scraped and assembled to fit the ways of the lathe. The stock is then clamped to the bed in a position between the headstock and the carriage. A boring bar is passed through the hole in the work and inserted in a specially made headstock spindle nose cap.

On the driving end of the boring bar, a long keyway is cut to a length somewhat longer than that of the tailstock spindle hole to be bored. This end of the boring bar is fitted into the headstock spindle nose cap with its keyway engaged by a fixed square key in the cap. The boring bar slides freely laterally through the nose cap but rotates at the same speed as the spindle. The other end of the boring bar is supported in a bearing clamped in the toolpost. Lengthwise movement is prevented by two washers on each side of the bearing and a nut. The boring or facing tool is inserted in a crossslot in the Ear and is clamped in position by a setscrew during boring. Cutting is accomplished by engaging the carriage feed. Roughing and finishing operations can be made with the same setup. When the operation is complete, the boring bar is removed to insert a new workpiece.

The accuracy of this setup relies upon the alignment of the nose cap hole and the toolpost bearing hole. The nose cap must be accurately fitted to the lathe spindle nose and is best bored after mounting. The bearing hole in the toolpost should also be bored out by the lathe with a boring tool chucked in the headstock. Once the bearing hole is bored and spot-faced the handles in the cross-slide and compound rest-slide should be removed to insure alignment will not be disturbed.

P. C. Sun Tainan, Taiwan



### controlling

### **BAR STOCK WHIP**

By B. H. Amstead\*

Associate Professor Mechanical Engineering University of Texas Austin, Texas

Stock whip is hazardous to operators and machines. It can be avoided by fast acceleration past certain critical speeds or controlled by placing tension on the bar stock. The author has determined these critical speeds both mathematically and experimentally. He lists them both with and without using tension.

HIGHER MACHINING SPEEDS, made possible by carbide and ceramic cutting tools, are putting unprecedented demands on both machine tools and stock. Machine tool problems created by these high speeds are being solved by making the machines more rigid, with greater mass and larger bearing areas.

The stock problem, bar stock whip is less easily solved. Higher machining speeds will cause longer lengths of bar stock to be used to reduce handling time in the machining cycle. And as either length or rotational speed is increased, the tendency toward bar stock whip is increased. The reasons for this action are known, but not easily controlled.

Cause of Bar Stock Whip: In Fig. 1a which depicts a typical method of holding bar stock for screw machine operations, A is a positive chucking device and B is a bearing that supports the shaft. The distance f is usually short and the cutting tool forces contribute but little to shaft vibration between A and B. The shaft center line between A and B does not coincide perfectly with the axis of rotation because the shaft lacks uniform mass

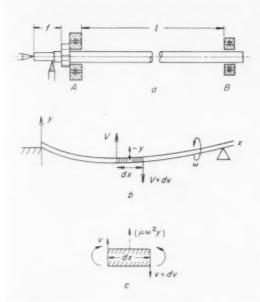


Fig. 1. Forces acting on a rotating shaft.

and straightness. Deflection occurs and is increased by centrifugal force. As the speed of the shaft is increased, centrifugal forces exceed elastic forces, instability results and the shaft—or the machine itself—will fail.

The speed at which this instability occurs is called the critical speed. Production men call it bar stock whip or "whirling stock." The forces involved are tremendous and the danger to men and machines is great.

As the speed is further increased past the critical speed a gradual return to stability results if sufficient forces are brought into play to restrict the movement at the critical speed or if the critical speed is passed over rapidly. Once the first critical speed is past, however, the next critical speed of the shaft, a harmonic, will be reached as speed is increased.

Analysis of Forces: There is an infinite number of equations defining a shaft rotating as in Fig. 1a. With the chuck end of the shaft rigidly

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#### Critical Speeds for Bar Stock

Distance Between Supports (ft)	First Critical Speed (rpm)	Second Critical Speed (rpm)	Third Critical Speed (rpm)	Fourth Critical Speed (rpm)	Fifth Critical Speed (rpm)
		1/4-in. Dian	neter Stock		
1/2	51,666		****	****	*****
1	12,916	41,855	87,312		
2	3,229	10,464	21,828	37,333	56,969
3	1,435	4,650	9,701	16,591	25,317
4	807	2,615	5,455	9,331	14,238
5	516	1,672	3,488	5,966	9,104
10	129	418	872	1,491	2,276
15	57	185	385	659	1,006
20	32	104	216	370	565
		½-in. Diar	neter Stock		
2	64,618				
3	28,719				
4	1,615	5,234	10,917	18,672	28,493
5	1,034	3,351	6,990	11,955	18,243
10	258	836	1,744	2,963	4,552
15	115	373	774	1,330	2,895
20	65	211	439	752	1,147
		3/4-in. Dia	neter Stock	k.	
1	38,708		****		****
2	9,677	31,359	65,416		
3	4,301	13,937	29,075	49,728	75,882
4	2,419	7,839	16,352	27,968	42,678
5	1,548	5,016	10,464	17,898	27,311
10	387	1,254	2,616	4,474	6,828
15	172	551	1,163	1,989 1,122	3,035 1,711
20	97	314			1,/11
1	51,719		neter Stock		
2	12,930	41,900	87,406		
3	5,746	18,620	38,843	66,435	*****
4		10,474	21,848	37,368	57,022
5	3,232 2,069	6,705	13,986	23,922	36,503
10	517	1,680	3,495	5,978	9,121
		745	1,555	2,660	4,058
15 20	230 129	418	872	1,490	2,276
20	20.7				
	00.003		meter Stoc		
2	25,851 11,489	83,773 37,231	77,666		****
4	6,462	20,941	43,683	74,714	
	-				
5	4,136	13,403	27,959	47,820 11,960	72,971 18,243
10 15	1,034 450	3,351 1,491	6,989 5,110	5,319	8,116
20	259	839	1,751	2,995	4,570
		5-in. Dia	meter Stoc	k	
2	64,635	****	*****		****
3	28,727	52,365	****	****	
	16,159		*****	*****	
5	10,341	33,511	69,905	20.000	AE 401
10	2,585	8,377	17,475	29,888	45,60° 20,27°
15	1,149	3,723	7,767	13,280	
20	646	2,093	4,367	7,469	11,39

Fig. 2. Strobe-lighted experimental setup corresponding to Fig. 1a, used to verify mathematical calculations. The ½-inch stock is rotated by the variable speed drive at the left, and tensioned at the right.

held and the other end held in a bearing or simply supported, the following derivation applies:

When a shaft rotating at an angular speed  $\omega$  is deflected an amount y due to the unbalance of centrifugal and elastic forces, the shear is V and (V+dv) across an element dx as shown in Fig. 1b. The differential element of the shaft through an element dx measured along its length has a number of forces acting on it, Fig. 1c. By adding the forces:

$$- dV = \mu \omega^2 (-\gamma) dx \dots (1)$$

where V = shear, lb; x = length of the beam from the rigid end, in.; y = deflection at any point x, in.; and  $\mu =$  mass per unit of length. Where M is bending moment, lb, shear is defined as:

$$V = \frac{dM}{dx} \dots (2)$$

From the general elastic ourve equation however,

$$M = EI \quad \frac{d^2y}{dx^2} = EI y'' \dots (3)$$

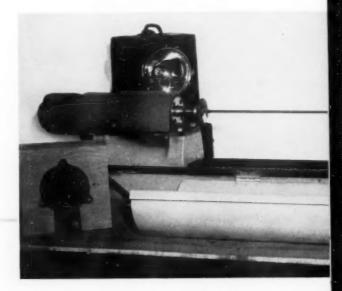
where E = modulus of elasticity of the material, psi and I = moment of inertia of the cross section of the beam about the neutral axis, in.<sup>4</sup> By substituting Equation 3 in Equations 2 and 1

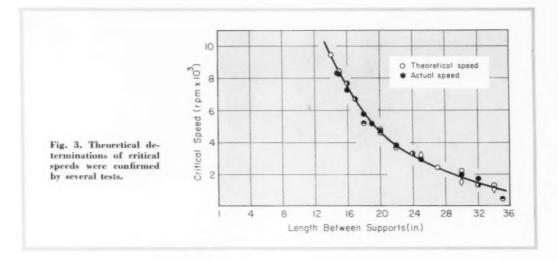
$$\begin{array}{cccc} \textit{EI} \textit{y}^{\textit{IV}} & -\mu\omega^2 y = 0 & \dots & \dots & \dots & (4) \\ \textit{y}^{\textit{IV}} & -\beta^4 y = 0 & \dots & \dots & (5) \end{array}$$

where  $\beta^4 = \mu \omega^2 / EI$ .

Equation 5 can be solved for ω by substituting various values of length and diameter for materials of a known modulus of elasticity.

Values of critical speeds for various sizes and lengths of round bar stock with the type support most commonly used are shown in the accompanying table. Other types of support can be treated mathematically in a like manner, and if one sets up the equations properly, the calculations will be close





to the results encountered in production.

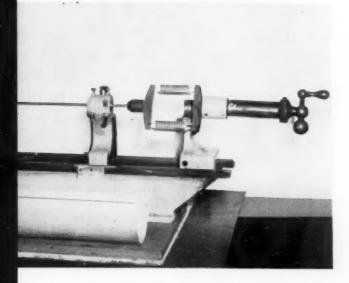
The drudgery of extensive calculations for Equation 5 can be reduced by using published solutions.\*

Verification of Analysis: To check the reliability of calculations, an experimental apparatus, Fig. 2, was constructed and the fundamental critical speeds of a  $\frac{1}{4}$ -inch shaft were determined. Fig. 3 shows the fundamental critical speed as a function of the length between the supports, both for the theoretical and experimental results. Excellent agreement is indicated despite the fact that no effort

was made to select a straight piece of bar nor to assure a definite bearing clearance.

The successive critical speeds of a shaft are harmonics of the fundamental speed and they are defined as second harmonic, third harmonic, etc. Fig. 4 shows the way a bar vibrates as the successive critical speeds are reached. The patterns shown can be easily observed with a stroboscope focused on the bar stock, flashing at the same frequency as the bar.

<sup>&</sup>lt;sup>6</sup> Young, Dana, and Felgar, Robert P. Jr.—"Tables of Characteristic Functions Representing Normal Modes of Vibration of a Beam," Engineering Research Series No. 44, Bureau of Engineering Research, the University of Texas, July 1, 1949.



Fundamental

Second Harmonic

Third Harmonic

Fourth Harmonic

Fig. 4. Fundamental and harmonic waves in whipping stock.

5 10 20 30 40 50 60 70 80 Spring force (1b)

400 600 800 1000 1200 1400 1600

Tension (psi)

Fig. 5. Tension on the bar raises the critical speed.

From a practical standpoint, bar stock should be revolved at a speed at least 20 percent below the fundamental of first critical speed or at speeds considerably greater than the fundamental critical speed. Successive critical speeds are far less detrimental to the machine and stock than the fundamental and first harmonic speeds.

Conclusions: It is difficult to damp the first critical speeds encountered in bringing bar stock up to an elevated speed, but if this critical speed is passed through with sufficient rapidity, the forces causing whip do not have time to develop. Hence, machines with high accelerations are preferred if bar stock is to be rotated at post critical speeds. The only economical way to raise the critical speeds of a given bar is to put it in tension. Compression lowers the critical speed and encourages buckling.

Results of applying varying amounts of tension to the 1/4-inch rod are shown in Fig. 5. Not only is the critical speed materially increased by applying even small amounts of tension, but also the amplitude of the vibrations is greatly reduced. By using tension, the damaging fundamental critical speed is passed with less motor torque and reduced vibration.

A simple thrust bearing held against a collar on the bar stock and pulled to produce sufficient tension will undoubtedly be a solution to bar stock whip problems at high rotational speeds.

#### Self-Broaching Fasteners Prevent Leaks



Possibility of leakage of liquid oxygen fuel is prevented in the Thor missile by use of self-broaching fasteners.

Engineers at Douglas Aircraft Company developed the idea of applying integral broaching teeth to a close-tolerance fastener, The fastener is able to automatically finish-broach its own predrilled hole during installation.

Huck Mfg. Co. is producing the new fasteners for the Douglas-built Thor. Tolerances and standards maintained during missile production with the fastener insure a precise fit within  $\pm$  0.00075 inch. The fastener is literally pulled into an undersize close-toleance drilled hole. Installation of the fastener pin is normally done "dry."

Liquid oxygen is capable of violent reaction when brought in contact with certain elements contained in many lubricants and sealers. Contamination could result in premature firing.

### putting

# Electronic Gages to work

By Fred W. Witzke

Cleveland Instrument Co. Cleveland, Ohio

Electronic gages are fast, accurate, versatile and reliable. They are equally at home in mass production inspection and in laboratory gaging. By connecting them with appropriate input and output equipment, they satisfy a wide range of gaging requirements.

Abstracted from Paper 245, "Modern Measuring Instruments," presented at the 28th ASTME Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters. EXTENDING considerably the ability of tool and manufacturing engineers to measure and compare, electronic gaging, as in Fig. 1, has reached a highly usable state of development. Ultraprecision electronic comparators, for example, have usable magnifications up to 200,000 times, or one-half millionth of an inch per division for gage block calibration and other extreme precision work. Height gage type electronic indicators have usable magnifications up to 50,000 times, or two millionths per division. Switchable magnifications give several scales to the same gage, permitting the measurement of thousand-ths, ten-thousandths and millionths on the same gage.

Stability of electronic gages has been improved so that drifts of less than two millionths of an inch occur during a 24-hour period under uniform environmental conditions. With such highly stabilized equipment, almost all drift is due to temperature or draft effects on the comparator stand, fix-

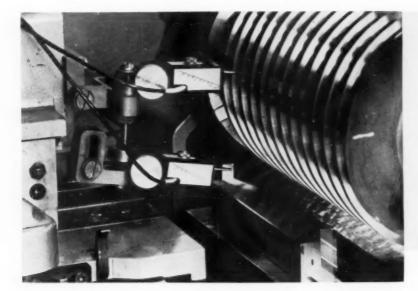


Fig. 1. Differentially coupled gage heads measure lead screws to gage block accuracy.

turing or part. Similarly, repeatability is a valuable characteristic of electronic gages. Gages now in use can repeat readings within 0.0000001 inch. Use of transistors has rendered gages compact and portable. Other design methods have made electronic gages capable of withstanding production conditions. Maintenance statistics indicate that the average electronic gage requires repair once every four years and that tube life is two to four years.

Gage Heads: Both contact and noncontact type gage heads are used in electronic gaging, the noncontact advantages of air gaging being coupled to the response and flexibility of electronic gages by use of an air-electronic transducer. Noncontact gage heads measure an area rather than a point. For measuring a point with contact heads, only low-gaging forces are required to actuate the frictionless reed type mechanisms. Gaging pressures range

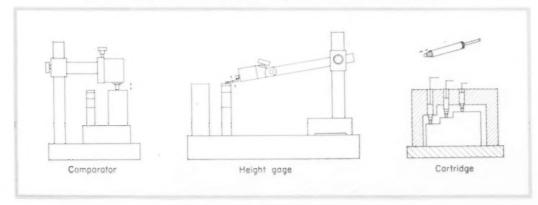
from two grams to several pounds. Several styles of contact gage heads are available, Fig. 2, to fit different types of gaging conditions.

Comparator gage heads are generally used where a large number of parts is to be gaged for the same dimension. They can withstand shock and do not lose their settings even under hard usage.

Height-gage pickups are usually used for measurements on a surface plate or other reference surface and gage settings are usually changed frequently. The extended gage tip permits the ready measurement of cavities, flanges and shoulders, but since the tip is exposed, the reference setting can be lost from an accidental blow. For this reason it is less suitable to production measurement than the comparator head.

Smallest of the comparator type gage heads, the 3/g-inch cartridge is primarily used on fixtures where space is at a premium. Since its diameter is the

Fig. 2. Comparator gage (left) is used for repetitive production gaging. Height gage (middle) is used for toolroom work. Individual gaging heads can be incorporated in a fixture (right) for long production runs of identical parts.



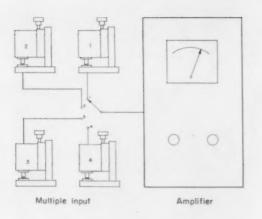


Fig. 3. Identical gage heads, ganged to one amplifier, can be switch-selected to read each head.

same as dial indicator stems and air cartridges, it can be substituted for them on many fixtures. Because of the limited size, bushings are generally used instead of reed mechanisms. The bushings can be a source of nonrepeatability when used on high magnifications.

Identical operating characteristics (within one percent) of gage heads permit the use of several gage heads with only one amplifier, as in Fig. 3, with a substantial savings in amplifier costs. Some manufacturers provide compensating controls to adjust gages until they are equivalent rather than building the gage heads themselves to be identical, to achieve the same effect. This characteristic has been used advantageously by a ball manufacturer. Eight gage heads mounted on individual ball-gaging fixtures are all connected to one amplifier. To check a certain size ball the inspector simply switches to the proper fixture and gage head without the need of readjusting the fixture mechanically or electrically.

Remote gaging, up to 1000 feet from the amplifier, is done with low-frequency excitation, as remoteness from radioactive, explosive or other dangerous environments is often desirable.

Rotating gage heads at comparatively high speeds with connections made through slip rings makes electronic gaging applicable to ultraprecision roundness gages and to hole location on jigborers.

Input-Output Analysis: For optimum use of electronic gaging it is productive to use the system concept when considering gage applications. That is, any possible gaging job can be regarded as a system, consisting of three parts: input, operation, and output. As the operation is primarily amplification, the tool engineer who is considering a gag-

ing system can restrict his examination to the nature of the input situation, and the type of output desired. Since this line of thinking offers great flexibility and little compromise in meeting gaging requirements, information on gaging applications has been grouped according to input situations and output requirements for convenience.

Inputs: Use of single or multiple head setups is generally indicated in an unambiguous fashion by the gaging situation. The type of head, and whether it shall be remote or rotated is similarly indicated. Use of two differentially connected gage heads is more involved. The two signals can be combined by means of special input circuitry to permit a valuable degree of data refinement at the input. For example, when a source of error affects both heads equally, the error can be cancelled out, as in Fig. 4. Types of errors cancelled by this means include movement and deflection of the part, work support, gage support, temperature and wear. High-precision measurements are thus obtainable without the use of high-precision fixturing. Routinely matched heads can cancel an error up to 100 times the desired gaging accuracy.

Thickness and parallelism measurements obtained using a differential setup eliminate many sources of error. The work support can be deflected by forces of several pounds without changing the reading, even at 200,000 times magnification.

Concentricity and wall thickness can be checked to an accuracy of millionths of an inch without ultraprecision spindles or centers. Using differential techniques as in Fig. 5, the part may be mounted and rotated on dead or live centers, rotary table, inspection spindle, or even in the production ma-

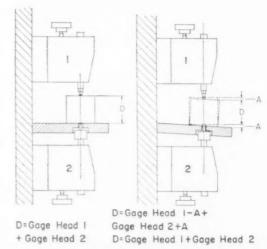


Fig. 4. Differentially connected gage heads cancel errors. Despite the fact that the part being checked at right has changed position, reading D is correct.

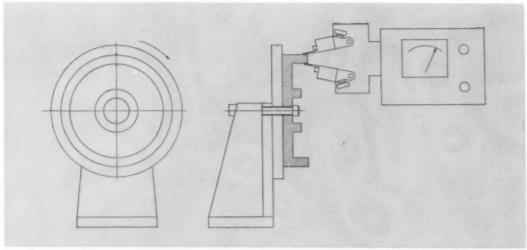
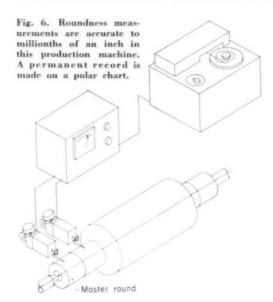


Fig. 5. Concentricity and wall-thickness measurement is accurate without requiring ultraprecision spindles.



chine. Rotational and part centering error can be up to 100 times greater than measurement accuracy desired. For example, a combined spindle runout and centering accuracy of  $\pm 0.002$  inch is sufficient for measuring to an accuracy of  $\pm 0.00002$  inch, which eliminates the need for an ultraprecision spindle,

Roundness measurements by differential comparison with a precision master, Fig. 6, can be accurate to millionths of an inch even with the part mounted in the production machine. Machine adjustments and corrections can thus be made any number of times without removing the part from the machine. This method is currently being used to machine bearing surfaces on 4-ton parts to a true radial roundness of 10 millionths of an inch.

Diameter and taper measurements made by calipering the part with differentially connected gage heads, Fig. 7, are very accurate even under adverse conditions. Errors due to deflection from the weight of the part, spindle or center runout and carriage movement are cancelled out. A manufacturer of steel rolls that weigh several tons uses this method. The gage heads are mounted on the carriage of the machine. The diameter is scanned by traversing the carriage.

Flatness and profile measurements are accurate to millionths when made by differential comparison of the part surface to a master surface, as in Fig. 8. For a production example, gun-breech contours are calipered by two gage heads, Fig. 9, and the resultant signal is compared to a master profile. This gage now performs more accurately in minutes an operation that previously took hours.

Direct comparison gaging, when parts must be identical although actual size itself is not critical, is readily achieved by the differential technique. When connected as shown in Fig. 10, the sum of gage inputs equals zero if the two parts are identical. The direct comparison system is used for spacer blocks, or for the ID of a cylinder and matching OD of a piston.

The National Bureau of Standards uses the differential system shown in Fig. 1 to measure lead screws to gage block accuracy.

Outputs: Since the gage input signal is easily amplified to power levels sufficient to drive a variety of devices, many types of outputs can be obtained from electronic gaging. Application suitability generally determines whether displays, permanent records, actuators or computers are the most appropriate output device for the gage.

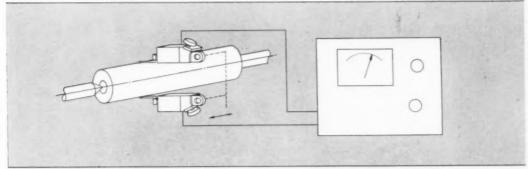


Fig. 7. Calipering to measure taper and diameter cancels deflection and runout errors.

Displays include conventional meters, digital meters, lights and oscilloscopes. Conventional meters are the least expensive but the usual meter accuracy (one to two percent full scale) and parallax reading errors limit their use in wide-range, high-magnification applications. Digital voltmeters with superior accuracy permit greater range, provide automatic polarity, decimal point indication, no parallax error and automatic scale selection. Lights are most often used to signal limits and part size categories. Oscilloscopes offer relatively high-frequency response and complex data presentation at comparatively low cost. Typically, they are used for ball-race waviness measurements.

Permanent records of measurements are made automatically, accurately and immediately by electronic gaging output equipment. A variety of methods and formats are available—strip charts, polar charts, XY plots, punched tape, cards and

printouts. Suitability of a given type of permanent record is determined by examining the number of variables being gaged and whether this information is best presented in analog or digital form. Analog recording produces charts and plots. Strip charts are most often used to plot the change of a single dimension, as for recording large numbers of readings such as gear and surface profiles. Polar charts are most applicable when the piece being gaged is usually defined in polar coordinates. Polar chart recording is often used on roundness and concentricity gages to conveniently indicate type and amount of out-of-roundness. A certain amount of data handling is achieved when frequency filters are used to accept or reject specific signal components. Data plotters, like polar charts, record two variables, but in a cartesian coordinate system rather than polar coordinate system. In one application, pressure applied to a preloaded bearing pair is plotted along the

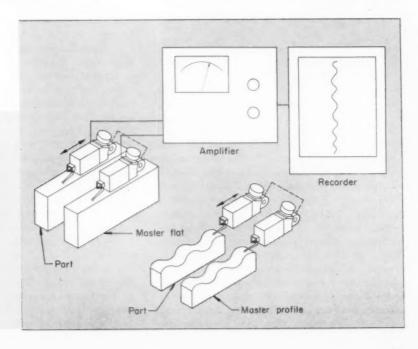
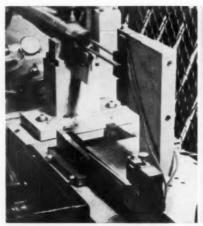


Fig. 8. Methods for measuring flatness and profile electronically.



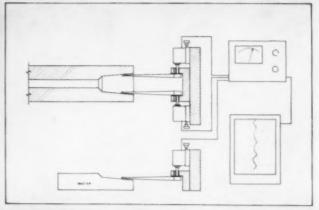


Fig. 9. Setup for gaging gun breeches.

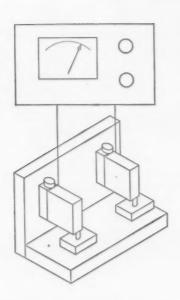


Fig. 10. Comparison gaging identical parts.

Y axis, as bearing shaft displacement relative to the housing is plotted along the X axis. Measurements are repeatable to a millionth of an inch. The setup obtains and plots data in less than two minutes with greater accuracy than was previously possible in one day. Digitally recorded information appears as punched tape or cards, tabulator, calculator and typewriter printouts. Digital records are most satisfactory where the data supplied by gaging will subsequently undergo mathematical treatment, as for quality control. If punched card equipment is being used for quality control, for example, then punched cards would be the most suitable form for recording inspection. Sometimes it is more convenient to

handle the measuring information as numbers rather than as lines on a chart. An automatic gage block certificate system typifies the advantages of direct printout. Since the gage operates the typewriter directly, note taking, typing and proof reading are not required.

Amplifier output can drive contact devices, thyratrons and servomotors for classifying and control functions. By using only one amplifier with a multiple contact relay meter, a large number of classification categories is provided in one setup that sorts transistor wafers into 12 categories at a rate of 4000 per hour. Using thyratrons to sense changes in amplifier output voltage, classification cycle time can be reduced to permit classification rates greater than 10,000 parts per hour. Since gaging is by nature a form of feedback, servomotors use gage output to position a part or tool as indicated by the gage head.

Computers, both digital and analog, can accept gage output for data reduction purposes. Surface roughness gages are a simple type of analog computer since they average the value of a continuously varying dimensional signal generated by surface irregularities. Roundness gages often employ a type of analog computer in the form of filters to discriminate certain signals. Digitalized output of gage amplifiers is suitable for use in digital computers, as for statistical analysis. The same digitalized output can also actuate punch requirement to feed data into off-line computers. Gage output in general can be data-linked to computers in whatever way most suits the needs of the situation.

Electronic gaging accuracy is of an order suitable for the most precise laboratory work. By its ability to withstand rough handling it is useful in production measuring. And by using input-output analysis, tool engineers can exploit electronic gaging versatility to achieve cost reductions and time savings in a wide range of applications.

# Quality Tooling

### proves economical

By Robert W. Reinhardt Manufacturing Consultant Detroit, Mich.

High-quality tooling for low-volume production is sound policy. Increased initial cost of such tooling, if evaluated in terms of uninterrupted production is a worthwhile investment.

Considerations of reliability, often subordinated to initial purchase price, should be evaluated in terms of downtime cost when machines and machine components are selected for production operations. Such an evaluation is particularly important when a steady flow of low-volume, high-quality production is required. In the event of breakdowns, high-volume production makes use of easily amortized standby machines and components but low-volume production cannot economically justify the use of such equipment. The logical and economically sound alternative is to minimize and in some areas entirely eliminate downtime through purchase of superior machines and tooling.

Cadillac Motor Div., General Motors Corp. provides an excellent example of the philosophy that reliability rather than cost is of paramount importance when low-production tooling is purchased. Cadillac's volume of production is small in comparison to that of other automotive plants; its production scheduling, however, is inflexible. To maintain an uninterrupted flow in the production line, machines and components are more reliable than would normally be required.

A specific example of Cadillac's emphasis on reliability can be found in the line producing ring gears for rear-axle assemblies. In the first machining operation forged blanks are held in a threejaw chuck mounted on a Bullard multiple-station chucking machine. Automatic power-chucking fa-



Diaphragm chuck for grinding pilot holes in gears.

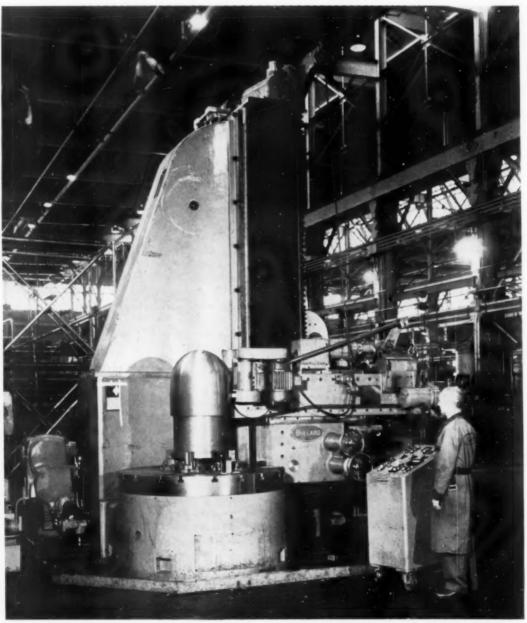
cilitates loading and unloading as well as maintains a correct pressure on the gear blank. Because the area where teeth will be cut represents a critical part of the blank, this section is used for purposes of location in preliminary machining stages. In these operations the equipment proves able to handle production requirements over extended periods without downtime resulting from machine failure.

Because production of gears in job-lot quantities does not warrant the use of conveyors, transportation to the heat-treating department is provided by hand-pushed racks. After hardening and inspection, hand operated racks are again used for transportation—this time to the grinding department.

Machining operations on the gears are completed with grinding of the pilot holes. Utilizing a Heald grinder and a Woodworth chuck, this operation has been continuous over a period of ten years with no mechanical breakdowns resulting from component failure in machine or chuck. After final testing and inspection, gears are ready for assembly operations in the rear axle.

Reliability of equipment and tooling used in manufacture of this gear typifies the company philosophy that limited production requires top-quality tooling if production volume is to remain constant. Purchasing decisions support this policy by an unusual method of selecting equipment larger and heavier than the manufacturer himself specifies for any given operation.

# designed for BRODUGION



CONTOUR GRINDING curved surface. All machine functions are controlled from console in right foreground.

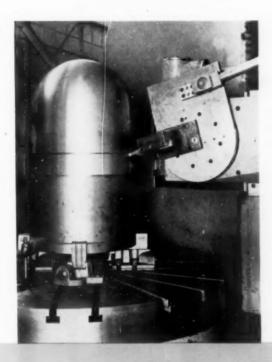
#### Turret Lathe Grinds Contours

Designed primarily for grinding contours of nose cones and other nonlinear surfaces, the tracercontrolled machine illustrated is also capable of internal and external machining operations. Produced by The Bullard Co., the machine utilizes many standard components normally used in vertical turret lathes and boring mills. However, a significant departure from standard design is found in the use of a side head instead of a ram type head. A tracer-controlled swivel plate mounted on the side head enables the machine to finish contours predetermined by a template.

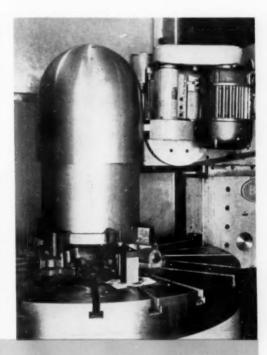
In operation, all grinder head movements are controlled by two followers which ride the edge of the template. Each follower has a separate function. One controls horizontal and vertical feed while the other actuates the swiveling mechanism. Movements of the followers can be made in either direction to provide both clockwise and counterclockwise head movement.

Outstanding advantage of this type of control system is that plane of the grinding wheel, at the point of contact, is always perpendicular to the plane of contour tangency. This results in longer wheel life and smoother surface finish than is possible with point-contact grinding—a technique which utilizes round faced wheels.

Conversion to machining operations is accomplished by removing the entire grinding unit and replacing it with a cutting tool. Turning of linear or convex surfaces can then be accomplished with the same type of setup used for grinding.



SWIVEL FLATE with grinding unit replaced by machining unit. Bar extending from plate governs all movements of the cutting tool.



CRINDING UNIT in operation. Unit can perform linear as well as contour grinding.

#### Electric Arc Saws Honeycomb



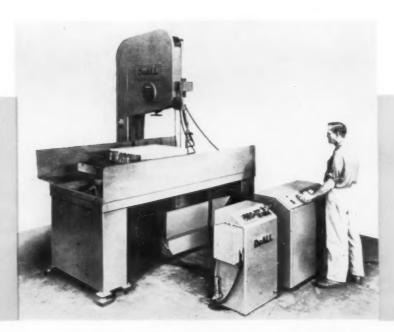
IN OPERATION a copious flow of coolant is required to quench the arc. Solution used is not an electrolyte.

E lectric-arc machining has been successfully adapted to band sawing with introduction of "quenched-arc cutting," a development of The DoAll Co. Unlike conventional electric-arc machining which requires immersion of the work-piece in an electrolytic solution, quenched-arc cutting utilizes air as a medium of spark transmission. Coolant is used, but its primary function is to limit the length of the arc. As in conventional sawing, it also serves to maintain normal workpiece temperatures while washing away cutting swarf.

In operation, the saw blade never comes in physical contact with the workpiece. Essentially an electrode energized by a low-voltage, high-amperage current, the blade rotates conventionally. Machine feeding is necessary to maintain proper relationship between voltage and feed rate. If feed is too fast, work is forced into the blade; if it is too slow, the arc is lost.

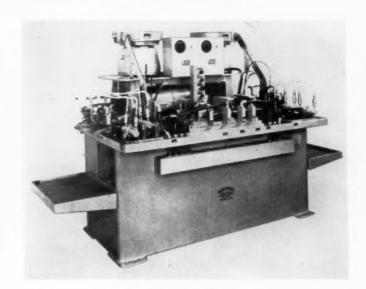
Quenched-arc cutting was developed primarily for sawing honeycomb. Effective on titanium, zirconium, aluminum, stainless steel and the superalloys, it can be effectively used on any cellular structures made of conductive materials.

ELECTRIC-ARC saw utilizes many components of conventional saws.



#### **Tapping Spindle Doubles Efficiency**

Tapping operations are among the most inefficient of all machining processes because of time lost in tap withdrawal. To increase efficiency in this operation, Bodine Corp. has produced a double-ended lead screw type spindle which carries a tap at each end. This design utilizes all spindle motion by making tap withdrawal at one end coincident with a tapping operation at the other end. Mounted horizontally at the front center of the machine and driven by a special reversing motor, the spindle can handle all taps in a range up to 11/4 inches in diameter.

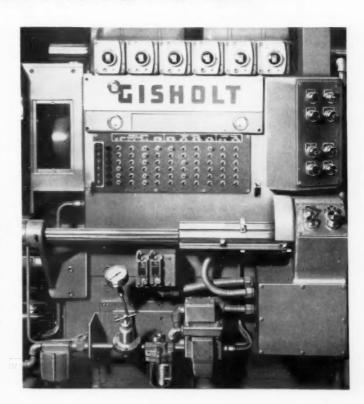


#### Control Panel Automates Turret Lathe

S etup time is reduced significantly and machining operations are automated with a control panel produced by Gisholt Machine Co. Designed for the company's line of turret lathes, the panel relates each face of the turret to ten separate machine functions. This is accomplished by six horizontal rows of ten toggle switches, each one of which must be preset for any given machine cycle.

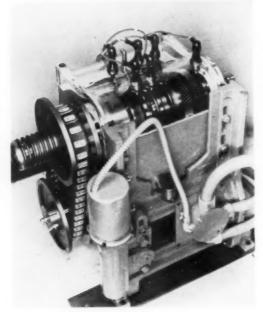
Feed rates for each turret station are regulated by control valves mounted on the headstock, above the panel. Rates are infinitely variable and can be preselected by reference to a feed rate meter.

By maintaining a job record sheet of each production run, setup men need only dial correct feeds and turn specified switches to re-establish a desired machine cycle. Setup is then reduced to selection and application of tools.



#### **DESIGNED FOR PRODUCTION**

#### **Electromagnetic Clutches Simplify Operation**

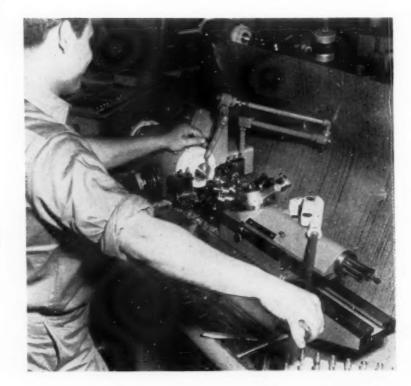


HAND TURRET LATHE in operation. Variable spindle speeds enable operator to perform rough and finish operations in one setup.

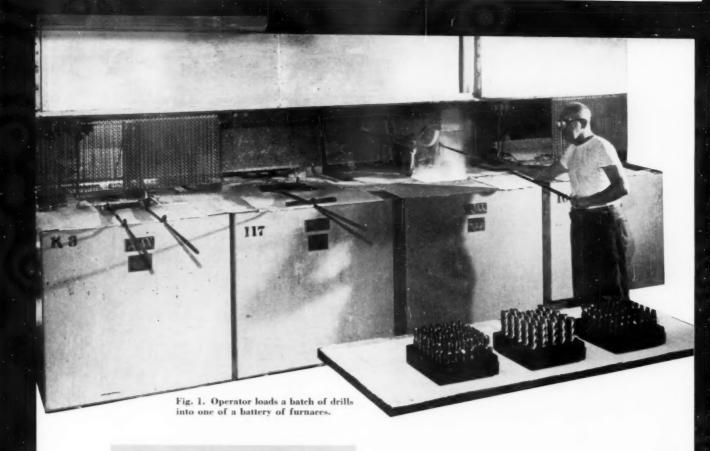
Increased machine versatility is effected through use of four electromagnetic clutches incorporated in the drive system of a new turret lathe manufactured by Wade Tool Co. Utilized to start, stop. change speed, reverse and brake the main lathe spindle, the clutches can be actuated either by pushbuttons or automatic control. Providing instantaneous response to operator demands, they effectively eliminate time lag and slippage normally found in conventional machines.

Over-all sizes of the clutches are small when compared to mechanical clutches of equal torque rating. Weighing from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  lb, the largest clutch measures 3.74 inch in diameter by 1.43 inch long.

Further improvement of machine operation results from use of a motor which runs at a constant speed in one direction only. Infinitely variable spindle speeds from 140 through 3500 rpm are regulated by variable pitch pulleys and high and low range adjustments on the clutches.



ABILITY of electromagnetic clutches to operate in oil permits their enclosure in a lubricated drive unit.



### heat treatment of tools

#### -with salt-bath furnaces

By Leon B. Rosseau

President Ajax Electric Co. Philadelphia, Pa.

Simplicity of equipment and operation, close control of temperatures, and fast heating make salt-bath furnaces extremely useful tools for toolmakers. Productivity is high and the salt prevents scaling during treatment.

Abstracted from ASTME Paper 298, "Principles and Characteristics of Salt-Bath Furnaces," presented at the 28th ASTME Annual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

Demands of tool manufacturers for fast, accurate heat treating are being satisfied today, as in the immediate past, with salt-bath furnace methods. Recent improvements in furnace design should make these methods even more widely used.

As their name implies, salt-bath furnaces, Fig. 1, are filled with molten salts. The operating range of these salts is generally from approximately 125 F above the melting point of the salts used to the temperature at which fuming or decomposition is encountered. In the low-temperature ranges—from 350 to 1150 F—a single salt is almost always used. Above 1200 F, mixtures of heat-treating salts having narrower operating ranges, generally from 300 to 700 deg Fahr, are used.

Some types of salts are neutral; others are used for oxidizing, reducing, carburizing or nitriding. As a result a very wide range of jobs can be done and substantially all the requirements necessary for proper heat treatment of tools are easily met.

#### Characteristics of Salts

Heat-treating salts provide a controlled atmosphere. As a result, scale is not formed and surfaces remain clean. Equally important, carburizing and decarburizing are easily prevented through the use of neutral salts. From this surface protection follow many advantages such as the ability to hold close dimensional tolerances and reduction or elimination of post-hardening finishing operations.

A second important characteristic of heat-treating salts is their high rate of heat transfer. The transfer of heat from molten salt occurs entirely by conduction at an equal rate on all surfaces of the work, regardless of the shape of the piece, and, to a large extent, regardless of the way in which it is loaded into the bath. The time required to stabilize a given size piece to furnace temperature is of the order of five minutes per inch of cross section and is approximately four times faster than radiant heating. A comparison of the rate of heating of lead, salt and a gaseous atmosphere for an identical piece is shown in Fig. 2. The high rate of heating permits much smaller furnaces to be used for a given production requirement, with a consequent smaller investment in equipment and floor space.

When a cold piece is charged into molten salt, a frozen layer or cocoon of salt completely covers it. The thickness of this layer varies with the type of salt and with the temperature, but will range from approximately  $\frac{1}{64}$  inch in thickness to as much as  $\frac{1}{10}$  inch. Frozen salt is an excellent insulator. The cocoon retards heat absorption, providing what amounts to an automatic preheat.

Temperatures within salt-bath furnaces are uniform, regardless of furnace size. Usually, temperature, even in large, deep furnaces, can be held within a 10-degree range.

Molten salts of the proper type are excellent quenching media and can be used in the temperature range of 400 to 800 F. They permit fast cooling with an extraction of heat capacity equal to or greater than that obtainable with quenching oils operating at room temperature. In addition, high,

operating at room temperature. In addition, high, closely controlled quenching temperatures are possible. This permits isothermal transformation of austenite in austempering and martempering.

Salt baths also permit accurate localized heating. The temperature of the salt is uniform right to its surface and the high rate of heating gives a sharp line of demarcation between the heated and unheated portions of a workpiece.

The greatest practical advantage of salt-bath heating is that it permits heat treatment with a minimum of distortion. The automatic preheat, the uniform rate of heating in a medium at uniform temperatures and the fact that a substantial buoyancy effect is present, reducing the weight of the work by some 20 to 30 percent and thus helping to minimize

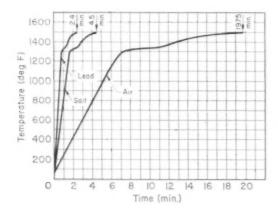


Fig. 2. (above) Comparative rate of heating for lead, salt (50 percent NaCl, 50 percent KCl) and air. Specimen is a one-inch diameter, three-inch long bar of SAE 1040 steel. Temperatures are measured at the center of the bar.

Fig. 3. (right) Surface-to-center H gradient in 2¼-inch round stock, Water is at 70 F; salt is at 450 F. Salt causes fewer stresses.

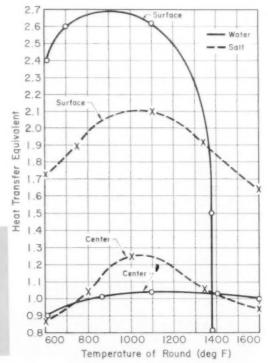




Fig. 4. Externally heated, fuel-fired pot furnaces.

strains, are all factors contributing to part accuracy.

The quenching characteristics of salt also help to prevent distortion. When quenching in salt at an elevated temperature, a relationship is established between the surface and the center temperatures of the work which is not obtainable in any other medium. This is shown in Fig. 3, which plots the H factor of water and salt at various temperatures for both the surface and center of a specimen. The spread between the two is much less when quenching in salt than in water, resulting in a similar reduction in the temperatures between surface and center and, therefore, fewer thermal stresses.

Salt bath furnaces have some limitations. Work introduced into molten salt must always be dry to prevent any possible splattering of hot salt. Furthermore, certain part shapes are impractical to heat-treat in salt, either because they will not readily sink below the surface of the salt or because they trap and remove substantial amounts of salt on withdrawal. Work that requires furnace cooling or slow heating generally cannot be economically treated in salt. Removal of the film of salt that coats the work requires washing and rinsing.

### Types of Furnaces

Many types of salt-bath furnaces are used. These differ with respect to the method of heating and to the type of energy used for heating. Externally heated, fuel-fired pot type furnaces are one well-known type, Fig. 4. They can be rectangular, although the majority are circular in shape since this design generally gives better and cheaper pot construction. The containers or pots are made of metal, quite often steel, which may be coated with nickel-chrome alloys or alumina for additional heat resistance. Some pots are made of heat-resisting alloys, cast in the shapes required; others are of wrought heat-resisting alloys, fabricated and welded to the proper shape. The cost of pots is increased in the order mentioned and, generally speaking, their service life corresponds to their prices.

Externally heated pot type furnaces are generally small and are best suited for intermittent use. They are limited to approximately 1600 F top temperature for use with neutral salts and 1700 F for use with cyanide salts. Although the initial cost of fuel-fired furnaces is low, they are often more expensive to operate than electrode type furnaces.

In electrode salt-bath furnaces the salt itself is the resistor and the electrodes are merely means of bringing the proper potential to the salt. In this type of furnace the pot is generally made of ceramic material, rather than metal. Ceramics last longer than metals and cost less. The electrode may be introduced into the bath from the top, in the case of metal pots, or through the walls in some manner

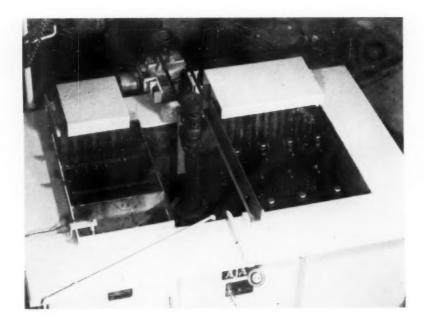


Fig. 5. Immersion heater type electric salt bath furnace.

when ceramic pots are used. This type of furnace can be operated from as low as 350 F to as high as 2350 F and is preferred for heat-treating many special tools, especially high-speed steel tools.

A third group of furnaces, Fig. 5, is heated by electric or gas-heated immersion tubes. Gas-tube heated furnaces cannot be built in small sizes. They are most economical, all things considered, for temperatures below 1000 F where large pieces or large quantities of work are processed.

A fourth type of salt-bath furnace is the quenching furnace. These can be either electrically heated by means of immersion heaters or gas heated, either externally or by immersion tube. Of the installations which are currently in service, however, a great majority are electrically heated. The following furnace characteristics are required:

1. Means for melting the salt, bringing it up to and

holding it at the operating temperature

- Means for cooling the furnace when hot work is quenched into it in order to automatically maintain a fixed quenching temperature
- Means for circulating the hot salt under controlled conditions in order to permit the most effective heat extraction from the work being quenched.

Often quenching furnaces are also provided with a means for automatically separating the high-temperature salt used for heating the work from the low-temperature quenching salt.

Because of their versatility, salt-bath furnaces are well-suited for the requirements of metalworking plants where through-hardening, case-hardening, annealing and rehardening of production tools are carried out. The manufacturers of cutting tools also use salt-bath furnaces to advantage because of the close control of quality in salt-bath heat treating.

# Rolling Mill Tames Plutonium

Designed to operate entirely by remote control within an airtight steel enclosure vessel, a new rolling facility for plutonium will be used to produce nuclear reactor fuel elements in a variety of shapes and configurations.

Although plutonium is not among the most radioactive materials, it is an alpha-emitter of high toxicity and therefore has to be handled with extreme care. The alpha particle has a relatively low penetration ability and can be stopped by a comparatively thin shield. The greatest danger at a processing plant handling plutonium is the inhalation of plutonium-bearing dust, rather than radiation.

Since plutonium readily oxidizes in air and there is a danger of spontaneous combustion, it is necessary to process the metal in an inert atmosphere of argon. For this reason the new mill has been designed for complete enclosure within a fabricated steel hood or glovebox.

The mill was designed and built by Loma Machine Mfg. Co. of New York and will be installed at the Hanford Works in Washington, which General Electric operates as prime contractor for the U. S. Atomic Energy Commission.

# in-process inspection

# -a must in missile machining

By W. Calebaugh\* and E. Scerbo\*

Ordnance Dept. General Electric Co. Pittsfield, Mass.

Modern positioning and measuring equipment make it possible to inspect a workpiece with laboratory accuracy while it is mounted in position for machining. This capability has greatly reduced scrap in the machining of high precision missile components.

W ITH THE ADVENT of the Missile Age, tool and manufacturing engineers have had to develop techniques for machining production parts to tolerances comparable to those applied to gage blocks only a few years ago. Machine tool builders have responded to this challenge and great improvements in machine tool accuracy have been made. In order to exploit the accuracy of these machines, fixtures must be capable of similar high accuracy.

Where several operations are performed on one part, a method for checking the accuracy of each operation before succeeding operations are performed is almost a necessity. If inspection is deferred until all operations have been completed, it is possible to complete operations on a part that should have been scrapped because tolerances were not maintained on an early operation. All subsequent operations on that part are, of course, wasted, Means for checking the accuracy of the setup before each operation is performed are also essential.

Machining of a gimbal, Fig. 1, illustrates some

of the problems faced by missile manufacturers. This part, Fig. 2, appears rather simple to machine but, owing to the close tolerances required, extreme care must be used. Centerlines A and B must intersect within 0.001 inch, and be perpendicular to each other and parallel to surface R within 0.001 inch in 10 inches. Surfaces W and Y must be parallel to each other and perpendicular to centerline B within 0.001 inch in 10 inches. Surfaces X and Z also must be parallel to each other and they must be perpendicular to centerline A within 0.001 inch in 10 inches. Coaxial alignment between bores must be held within 0.0005 inch, total indicator reading (0.00025 inch eccentricity).

Facing and boring operations are performed on a DeVlieg jig mill. Originally, the gimbal was held in an indexing fixture that located it from the inside surfaces. Auxiliary feet cast on the gimbal made it possible to clamp it to the fixture base. Maintaining the required squareness and parallelism of the sides was no problem, but maintaining coaxial alignment between bores was extremely difficult. The indexing table, the most accurate obtainable at the time the part was first processed, repeated with a probable error of five seconds. A five-second error in angular deviation could amount to a linear inaccuracy of 0.000242 inch per 10 inches. This angular error, plus movement of the head spindle and table position of 0.0001 and 0.0002 inch caused by heat expansion, plus the somewhat limited repeatability of standard measuring rods and micrometers, made it virtually impossible for the operator to determine whether or not required tolerances were being held during machining.

Inspection of completed parts also presented a

<sup>\*</sup>Senior member ASTME Springfield (Mass.) chapter.



Fig. 1. Special fixture for machining a missile part. Part is positioned for machining by a precision indexing table. This fixture was developed by A. A. Gage Co. and Michigan Tool Co.

serious problem. Mechanical indicating fixtures did not possess sufficient sensitivity for the small measurements required. Air gages would work, but a considerable amount of computing would be required to define any errors on the part.

Both machining and inspection problems were solved by the design of a special fixture that permits inspection between operations, Fig. 3. The fixture also permits the relation of the machine spindle and table with true center to be checked.

The fixture has a Meehanite base. Mounted on the base are an Ultradex index table that locates the part for machining and a bearing-mounted precision bushing that accommodates an electronic plug gage. A master locating plate, mounted on the indexing table, holds the part, which is located from a previously machined inside surface. Pads on the master locating fixture are level within 30 millionths

of an inch. The indexing table has a radial locating and indexing accuracy of ½ second of arc, or six millionths of an inch at a one-foot radius.

Three ranges of measurement are obtainable with the electronic gage: low (to 0.001 inch); medium (to 0.0001 inch); and high (to 0.000020 inch). This wide range facilitates machine setup.

Indicating surfaces on the fixture base are used to align the fixture with the machine spindle before it is clamped to the machine table. The inside contour of the gimbal, which has been previously machined, fits against machined angle plates on the master locating plate and is held down against the locating pads by four acorn-nut clamps that are tightened with a torque wrench. The machine spindle is approximately located from a construction hole in the gimbal.

A preset roughing bar bores the first hole. Then

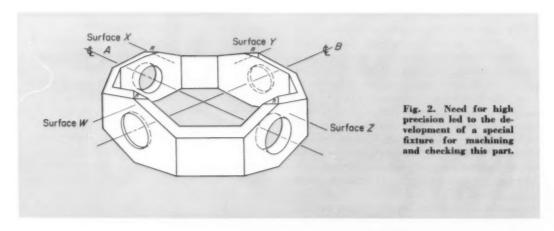




Fig. 3. Probe is inserted through bushing into hole in part to check accuracy of machining operation. No subsequent inspection operations are required. The electronics package was built by Industrial Electronics, Inc. It magnifies deviations.

the table is indexed 180 degrees and concentricity is checked with the plug gage and electronic indicator. Any necessary changes in spindle position are made at this time. The hole oposite the first hole is then bored and checking is repeated until optimum accuracy is achieved.

With the spindle in correct alignment, all holes are rough and finish bored. Concentricity is checked constantly, using the gage range best suited for each hole diameter. All diameters are measured with air gages as soon as they are machined. Set blocks on the master fixture are used in fly-milling the sides of the gimbal. Squareness and parallelism are

checked using an adapter that slides over the plug gage. Accuracy is read from the electronic gage, which magnifies deviations.

Since deviations in concentricity, squareness and parallelism can be read to accuracies of 0.000020 inch, no postmachining inspection is required. Readings taken at the machine are recorded for quality control purposes.

Production experience with the special fixture has shown that, because of its simplicity, it can be used by any operator after a short learning period. Part accuracy is easily maintained because of the inherent accuracy of the fixture itself. This improved accuracy has eliminated scrap caused by poor concentricity, parallelism and squareness. Consequently, costs per part have been reduced and production schedules are being met.

# Drilling the Mohole

American scientists are planning one of the most important drilling projects in history—drilling the "Mohole." They plan to penetrate to Mohorovicic discontinuity ("Moho")—the boundary between the earth's crust and mantle—in order to determine the composition of the interior of the earth.

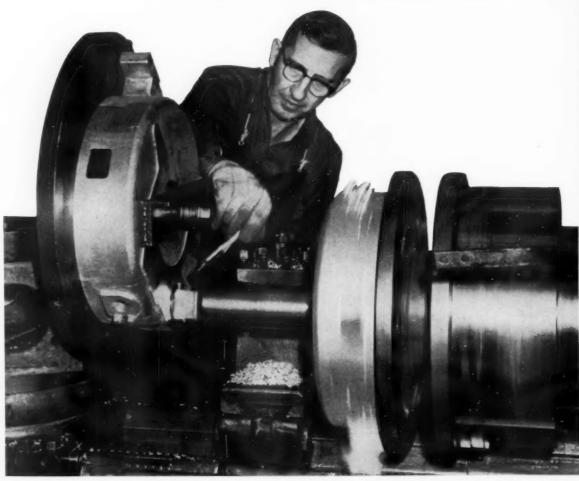
Since the earth's crust is thinner under the surface of the oceans than under the continents, drilling operations will take place in water as deep as 12,000 feet. It is expected that the earth's mantle will be reached some 24,000 feet below the ocean's bottom.

Analysis of sediments at and far beneath the ocean floor should contribute importantly to man's understanding of the evolution of life on this planet.

Industrial Distributors (1946) Ltd. has offered to provide diamond stones for exploratory drilling.

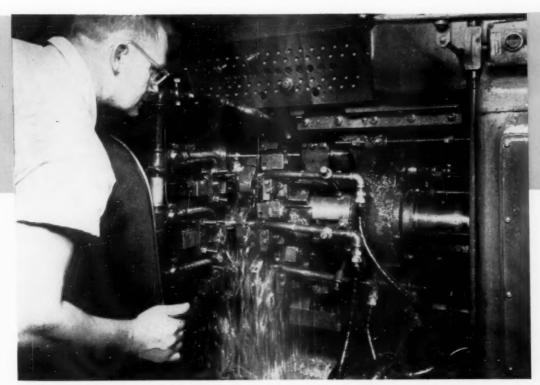
Drill bits will be produced by Christenson Diamond Products Co. of Salt Lake City.

# TOOLS at work



SAVING IN FLOOR-TO-FLOOR TIME is achieved at Hobart Brothers Co. by handling two chuckings simultaneously on a single Warner & Swasey saddle type turret lathe. Cast aluminum flywheel housings for engine driven generators are placed in a spindle fixture for second-operation rough and finish facing from the square turret. This fixture is mounted on the face of an 18 inch 3-jaw chuck. Centered on the fixture is a special 3-cutter boring bar which

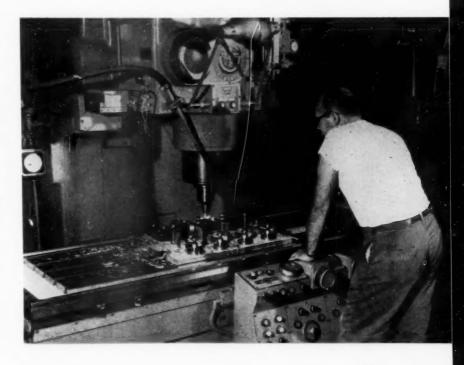
extends through the center hole of the workpiece. While the facing cuts are progressing, a second housing is clamped in a special hex turret fixture for third operation rough boring, finish boring and chamfering the off-center starter hole. The hex turret is advanced to the revolving 3-cutter bar. As the turret feeds toward the spindle, the rough boring cut is completed first, then the finish boring cut, and finally chamfer. Speed used is 264 rpm.



MACHINING SHAFTS for fractional horsepower motors, General Electric Co. uses a dual purpose cutting oil on two Conomatic bar machines. A sulfo-chlorinated fatty oil, Gulfcut 41B, serves both as a cutting

fluid and as a lubricant for the headstock and other working parts of the automatic bar machines. The requirements for each function are met by blending in additives needed to give desired properties.

NUMERICALLY CONTROLLED Cincinnati Hydrotel cuts aircraft lift spoiler hinges from steel blocks at Aeronca Mfg. Corp. Eight-position fixture permits one cutter to complete eight parts before cutter change is required. While cutter works a set of four parts, the operator loads another set. Operator controls speeds and feeds within maxima set by punched cards.

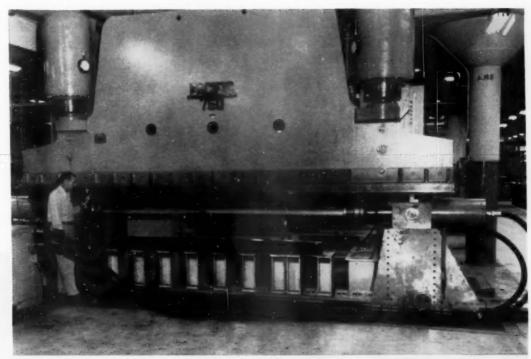


MACHINIST PREPARES to ream the chamber of a rifle barrel on a turret lathe at Marlin Firearms Co. Steel used is Jones & Laughlin modified C-1137 in which manganese, carbon and sulfur are adjusted for best machinability.



ASSEMBLY OPERATIONS ARE COMBINED into the same setup used to drill and tap assembled parts on a Burgmaster bench model six-spindle drilling machine. An air cylinder-operated fixture presses together two parts, a dial and a knob, then holds the assembly for drilling, tapping and fastening by a socket set screw. The machine power indexes at operator command. The turret is double tooled to eliminate indexing past idle stations.



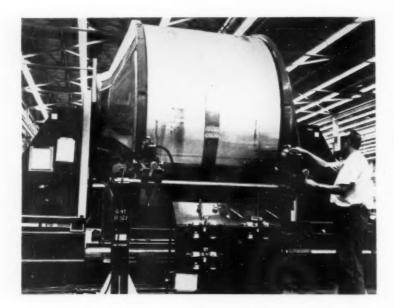


SPRINGBACK IS ELIMINATED in stretched shapes with a combination hydraulic press brake and stretching machine at Chance-Vought Aircraft Co. Extrusion is stretched to the desired length and piece is formed and set by impact of 750-ton hydraulically operated ram. Pieces up to 16 ft long can be worked on the 20-ft press bed. Press brake was manufactured by Pacific Industrial Mfg. Co.

# TOOLS at work

CARBIDE CUTTER 10 inches in diameter cuts stainless steel honeycomb at Rohr Aircraft Corp. Tool has Kennametal grade K92 cutting ring ground with a 1-deg dish angle and hollow ground on top to an 18-deg included angle. Feed rate on a bed type planer mill is 125 to 150 ipm. Cuts are 3 to 5 inches wide. Honeycomb is rigidly held in a refrigerated chuck in frozen water or soap.





ALUMINUM SHEET, formed into a 105-inch diameter skin segment for a Saturn interplanetary space vehicle, is trimmed in a rotating fixture. Trimming insures precise alignment when sections are joined together by circumferential welding. Material is Alcoa alloy 5456.

DD 3 at work

REDESIGN OF WELDED FRAMES of flat-bed trailers of the Fruehauf Trailer Co, has significantly increased load capacity and reduced weight. Sixinch junior beams, lightweight structurals made by Jones & Laughlin Steel Corp., are used as the cross members. These are inserted through punched holes in webs of two longitudinal fabricated I-beams.

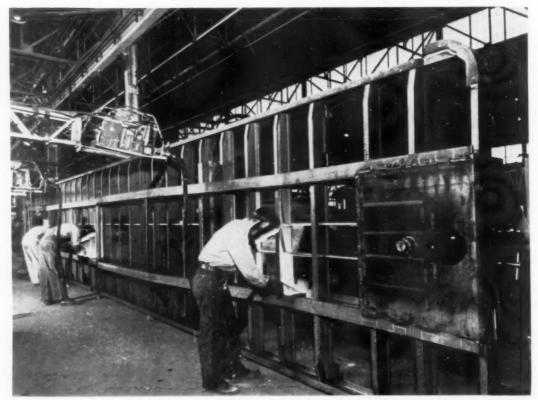




Fig. 1. Numerically controlled automatic turret lathe functions well for both long and short runs.

# numerical control

# increases turret lathe output

By Robert Heslen Associate Editor

Applying a simple numerical control system to an automatic turret lathe reduced setup time by 2½ hours and machining time per piece was cut by 11 minutes.

Licreasing machine tool productivity can be accomplished in several ways—by using transfer techniques for high-volume production, by installing automatic accessories and by applying numerical control. The different methods are compatible since they all have the same objective, greater productivity. Combining methods can improve results.

Exemplifying the combination method is a Gisholt Fastermatic automatic turret lathe operated under numerical control, Fig. 1. Automaticity is obtained by hydraulic actuation with sequencing control by stops, limits and cams. Gisholt engineers felt productivity could be increased by superimposing numerical control on the existing automaticity of the machine, especially since the machine lends itself readily to numerical control. Being automatic, it is accurate, responsive and stiff as required for numerical control, and the actuators are already an integral part of the machine.

Control System: Using numerical control gives greater control over operator-influenced variables and renders the machine more flexible for handling a variety of jobs, both short and long run. One-axis coarse positioning is provided with rate control to the final point. Automatic functions of the machine are driven from taped commands. The control is digital throughout, including feedback.



Fig. 2. Commutator V-rings are machined in about three minutes under numerical control.

Control system hardware, developed by Westinghouse, uses Prodac (Program for Digital Automatic Control) logic elements. These transistorized NOR logic units are mounted on plug-in modularized boards and handle both switching and storage requirements. Proven in use for process control, as in steel mills, this is the first instance of their having been applied to machine tool control.

Input is a punched paper tape that contains wordaddress commands. That is, each function-feed rate, spindle speed, distance command, sequencehas an "address" (the relay or actuator it controls) and an associate "word" (the amount of the command.) Commands can be dispatched to addresses in any order within a block of tape. The tool engineer preparing tape, on a Flexowriter or similar device, is thus relatively unrestricted by tape format in selecting an order of events for machining a piece. Commands are distributed to their destinations via transistorized switching. Distance commands are stored in a digital counter. Rate commands are decoded into voltage levels that drive the ram at the tape-indicated speed. As the ram moves, pulsed digital feedback subtracts counts from the distance command stored in the counter. Null indicates that the coarse position has been reached.

Machine Operation: For a typical sequence, a tape block is read in. Turret face is checked, spindle speed is set, coarse distance command is read into the counter and the feed rate command is read into the decoding matrix. As the turret slide advances at 600 ipm, feedback pulses count down the tape-set counter contents. Before reaching the coarse position, the counter reaches a slow-down level that removes power from the ram, allowing the slide to coast to coarse position without an abrupt cutoff shock. Cutting movement to final position is at the rate indicated on the tape. Final position is indicated by a stop, part of the tooling. During the final-positioning phase, the next block of tape is read in, so that as soon as the machine has completed a command, the next command is waiting to start the next sequence.

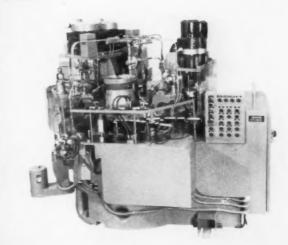
The machine has already been put to use in production to machine motor V-rings, Fig. 2. On a manually controlled machine, setup required four hours, and machining 14.5 minutes. Using the numerically controlled machine, setup time was reduced to 1.5 hours and machining time required about three minutes. Further, the numerical machine produced better accuracy and finish. As this operation develops, preset tools will be used to reduce setup time. The machine will be used primarily for producing V-rings, required in a variety of sizes in lots of approximately two to 25 pieces. Storing most of the part-to-part differences on tape will speed job changeover. The automaticity of the machine provides efficient machining cycles. Numerical control gives the machine flexibility and speed in changing from one job to another.

Notable gains in productivity can be made by applying a relatively simple numerical control system to an already automatic machine. At the present state of the art, numerical control is far from having begun to exhaust the ways it can improve manufacturing ability and productivity.



"Would you mind okaying it—I'm trying to overcome feelings of insecurity, frustration, inadequacy and hopelessness. . . ."

Fig. 1. Sixteen-station automatic assembly machine, designed to produce a superior product efficiently at less cost.



improving reliability of

# Automatic Assembly Operations

By Arthur J. LaRue\*

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Reliable production from assembly machines depends on two factors: the reliability of individual assembly stations and the quality of the components assembled. Recognition of these two factors led to highly efficient automatic assembly of complex electric relays.

Abstracted from Paper 263, "Some Quality Considerations in the Design of Automatic Assembly Machines," presented at the 28th ASTME Annual Meeting. Copies are available for purchase from Society Headquarters.

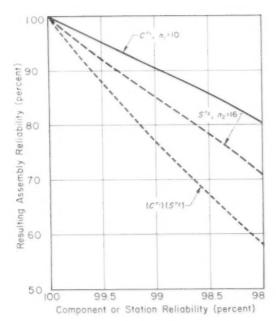
\*Senior member ASTME Mid-Hudson chapter.

Replacing the manual assembly of wire contact relays by an automatic assembly machine, Fig. 1, at IBM recently provided an opportunity for tool engineers to make several important discoveries about machines and men. Achieving manlike reliability in machine operation became the means of obtaining the advantages of automatic assembly.

Reliability Requirements: Successful automation of precision assemblies, such as the wire contact relay, Fig. 2, requires quality considerations exceeding those usual for manual assembly methods. Quality level of the end product depends primarily on two important factors: component reliability and machine station reliability. Adaptations of standard mathematical statements demonstrate with mathematical rigor the importance of reliability in these two areas.

A reliability computation for an assembly is  $(C_1)$ 





Component and machine station reliability af-

Fig. 2. Three stages in assembly of the wire contact relay, used in computers, data processing machines and missiles. This relay is almost entirely assembled by two automatic assembly machines.

Fig. 3. Component and station reliability affect product quality geometrically.

fects assembly reliability geometrically, as is shown graphically in Fig. 3. To operate efficiently, an automatic assembly machine should receive 100 percent acceptable parts and not 99.5 percent as some sampling methods permit. For example, in a ten-component assembly with 99.5 percent component reliability the assembly reliability is 0.99510 or 95 percent. If machine station failures of a 16station machine are included, the reliability of the assembly is 0.99526 or 87.78 percent. Thus, under these conditions an assembly machine with sixteen 99.5 percent reliable stations, assembling 10 components that are 99.5 percent reliable produces 87.78 percent acceptable assemblies and 12.22 percent rejects. In a machine producing 1000 assemblies per hour, this would result in almost 1000 defective assemblies daily.

In machines which combine machining operations with assembly, product reliability is decreased when two mating components have dissimilar reliability curves, even when both components are acceptable. A typical example occurs when tapping is done at one station and a screw inserted at another. Unacceptable fits occur even when both components are acceptable, as shown in Fig. 4. Moreover, the conditions may be compatible at the start of operations but fits become loose as the tool wears.

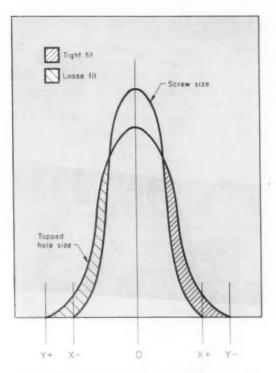


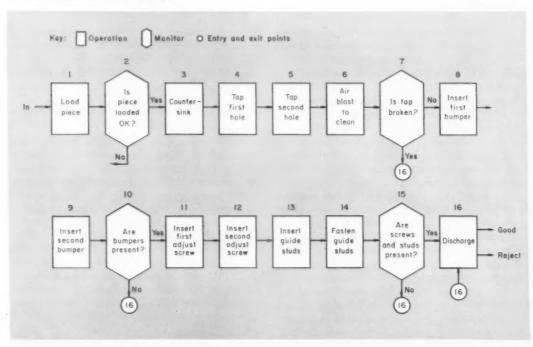
Fig. 4. When two parts of an assembly mate, dissimilar tolerance curves cause rejects even when both parts are within tolerance.

Fig. 5. Four of the sixteen stations of the first stage assembly machine monitor the machine's performance to increase over-all reliability.

Design Experience: Detailed analysis of component quality and thorough consideration of possible causes for machine station failures were made at IBM. But early experience with the prototypes proved that designing to blueprint specifications of component parts was not enough. Quality in designing, building, development and selection of components demands careful scrutiny.

To provide operational prototypes with maximum reliability, efforts were made to error-proof the machines. Operations of the first-stage assembly are charted in Fig. 5 to show logic design. Of the sixteen stations, four are monitorial functions intended specifically to ensure corrective action when failures occur. Similar precautions are taken in the second-stage assembly machine. Despite these precautions, the machines could not cope with all discrepancies and to check for all conditions on all components would have resulted in cumbersome equipment. Corrective effort had to be applied at the source.

The twelve components of the relay all meet stringent quality requirements. Despite the high level of quality in these components, automatic assembly was hampered by contaminants and other conditions that skilled assemblers handled routinely. An example of the contaminant problem is the assembly screw, Fig. 6. Similar difficulties encountered were flash between plastic blocks that inhibited feeding the piece, bowed pieces, unslotted screw heads, and so forth. Most of the difficulties involving components were traced to suppliers and remedied at the source. In the case of the contaminated assembly



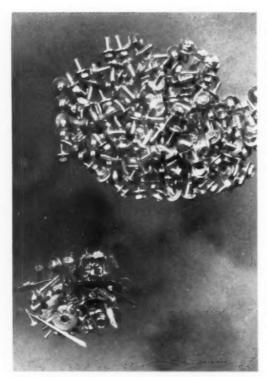


Fig. 6. The machine tried unsuccessfully to assemble relays with contaminants (below) received in vendor's shipments of assembly screws.

screws it was found that much of the trouble was due to the failure of the supplier to clean his plating barrels properly. On other parts, specifications were changed, inspection was made more rigorous and packaging methods were redesigned to make component parts more suitable for use in the automatic assembly machine.

Station failure for causes other than component conditions was a lesser source of trouble and was usually traced to mechanical wear, lack of adjustment, broken tools and obstructions in feed tracks. Regardless of the causes for station failure however, the failures affect reliability and quality.

Designing automatic assembly machines reveals the extent to which human perception, skill and experience enter into the quality of the product. The automatic machine can assemble similarly, by monitoring its own operation and by using improved components. When inferior components, contaminants and faulty machine stations cause automatic assembly machines to fail, the failures can be minimized, augmenting the economic advantages of the machine. By failing, the machines serve as ruthless inspection devices, ensuring a superior product.

This high level of production efficiency can be realized by tool engineers only by striving for quality at the outset. By increasing quality in both components and machines, the automated factory can become an economic reality.

# Avoiding Breakage During High-Speed Assembly

H<sub>ICH-SPEED</sub> automatic assembly methods are essential to low-cost mass production, but loss of the "human touch" often results in damage or breakage of parts. In the design of electrical insulation parts the problem becomes more acute because insulation materials are developed primarily for the dielectric properties rather than mechanical strength.

Laminated plastics can provide an answer to design problems where both strength and insulation properties are required. At the same time, laminates can also provide close punching tolerances and resistance to humidity,

An example of the ability of laminated plastics to meet these varied requirements is the use of a paper base, phenolic resin laminate with high insulation resistance in twelve-point radial stators for radio and television wave band switches. The stators, made by Taylor Fibre Co., have to meet stringent requirements. Close tolerances on the dimensions of the punched holes and the spacing between them is necessary to provide close alignment of contacts to stators and to make sure that contacts are securely fastened to the stators. Resist-

ance to breakage during high-speed assembly is essential to economical production of the switches. In addition to these mechanical qualities needed for efficient production, the electrical properties of high dielectric strength, insulation resistance and ability to retain high electrical properties under humid conditions are characteristically required of switches in RF circuitry.

Careful tool and die work solved the tight tolerance problem. Many of the tolerances are held to ±0.002 inch. Laminated paper base plastic containing plasticized resin facilitated hot punching of the parts. Because of their strength, the stators are assembled in high-speed automatic equipment without breaking. Adequacy of electrical properties was verified in humidity cycling tests.

Whenever components are to be used in automatic assembly machines, lack of the human touch implies that though the machine can assemble efficiently, it lacks human skill and judgment. Tool engineers must investigate beyond the blueprint and design specifications, or successful operation will be hampered by breakdowns.

# Milling High-Strength Alloys

By Norman Zlatin\*

Vice President Meteut Research Associates, Inc. Cincinnati, Ohio

and

Robert Krueck

Project Engineer Aeronautical Systems Center Wright Patterson AFB, Ohio

Current trends in missile and aircraft manufacture have increased demand for ultrahigh-strength alloys. In many cases these alloys are so new that no machining information is available for use in setting up production machining operations. Presented here are results of extensive research to determine machining characteristics in milling.

Three major factors are the sources of much of the difficulty encountered in machining highstrength and thermal-resistant alloys. These are:

- Abrasive character of metal—determined by the nature and distribution of the microconstituents
- 2. High temperature at the edge of the cutting tool
- 3. Tendency of the metal to work harden.

Generally, with respect to high-strength alloys the first two factors are most important; with respect to stainless steels and high-temperature alloys all three have significant effects.

# **Medium Carbon Alloy Steels**

Over the hardness range usually encountered in annealed medium carbon alloy steels, milling operations (particularly face milling) do not present a formidable problem. However, the situation is quite different for this group of steels when they have been quenched and tempered to a hardness level over 400 Bhn. A normalized 4340 steel (321 Bhn) can be face milled with carbide at about 400 fpm; the cutting speed on the same steel when quenched and tempered to 514 Bhn is only 150 fpm.

Not only is the cutting speed critical in face milling 4340 steel at a high hardness level but so is the feed per tooth. Experimental work shows that at the optimum feed of 0.005 ipt a tool life of 90 inches of travel per tooth can be expected (down milling), while at half that feed or 0.0025 ipt, the tool life is 20 inches and at 0.010 ipt it is only 10 inches.

Other factors must be carefully controlled in milling hard steels. Face milling cutters must be accurately ground so that runout is minimized. A cutter with a runout of 0.001 inch will produce 25 percent more parts than a cutter having 0.003-inch runout. The runout should never exceed 0.002 inch, otherwise the tool life will be shortened.

A relatively small increase in hardness level above  $49~R_{\rm C}$  results in a considerable decrease in tool life when using high-speed steel cutters. In one case tested an increase in hardnes of only 2 points from  $49~to~51~R_{\rm C}$ , the metal was virtually unmachinable with high-speed steel tools.

Light feeds are recommended for end milling hard medium carbon steels. As an example, at a feed of 0.0015 ipt, 70 inches of a workpiece was machined with a carbide end mill at a depth of 0.250 inch and a width of 1.250 inches, while at twice this feed or 0.003 ipt, less than 5 inches was cut.

Another critical factor in milling hard 4340 steels is cutting speed. In a typical case at a cutting speed

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Abstracted from ASTME Paper 257, "Milling High-Strength Thermal-Resistant Alloys," to be presented at the 28th Annual Meeting. Copies of the complete paper are available from Society Headquarters.

of 50 fpm, the tool life with carbide end mills was 78 inches of metal machined. Increasing the cutting speed 20 percent resulted in a 25 percent decrease in tool life in this instance.

### Austenitic Stainless Steels

Cutting speeds recommended for austenitic stainless steels cover a wide range. Tool life curves for face milling several of these alloys with carbide and T-15 HSS cutters revealed that the cutting speeds for both annealed 19-9DL and solution-treated A-286 alloys are under 175 fpm with carbide cutters even though the hardnesses of these two alloys were only 207 Bhn and 190 Bhn respectively. The tendency of these alloys to work harden readily makes them more difficult to machine and is one of the principal reasons for the low cutting speeds. Also as a result of work hardening, both light and heavy feeds should be avoided. The feed should be retricted to the narrow range from 0.008 ipt to 0.012 ipt. When end milling these alloys with HSS cutters, the feeds should be between 0.0015 ipt to 0.004 ipt.

### Key to Charts

AR = Axial relief angle
RR = Radial relief angle
ECEA = End cutting edge angle
CA = Corner angle
CI. = Clearance angle
RHH = Right-hand helix angle
PC = Peripheral clearance angle

### Martensitic Stainless Steels

Martensitic stainless steels are straight chromium types hardenable by heat treatment. There is a tendency for carbide cutters to chip if a feed of greater than 0.001 ipt is used in end milling 410 stainless having a hardness of 45  $R_{\rm c}$ . With a T-15 HSS cutter, a feed of 0.002 ipt can be used satisfactorily; however, the tool life drops off rapidly at feeds greater than 0.002 ipt. Tool life curves developed for this alloy indicate the need to maintain

Table 1—Recommended Cutting Conditions for Milling Martensitic Low Alloy Steel
AISI 4340 Quenched and Tempered to 49-52 R<sub>C</sub>

Milling Operation	Workpiece Hardness. (R <sub>C</sub> )	Tool Material	Tool Geometry (deg)	Depth of Cut (in )	Width of Cut (in )	Feed (ipt)	Cutting Speed (fpm)	Approx. Tool Life (ipt)	Cutting Fluid
Face Milling	52	C-6 Carbide	AR:0 RR:-15 ECEA:5 CA:45 CL:8	0.100	2	0.005	150	65	None
Side Milling (up)	52	C-6 Carbide	AR:-5 RR:-10 ECEA:5 CA:45 CL:8	0.100	13/4	0.0075	150	65	None
Slot Milling (down)	52	C-6 Carbide	AR:5° RR:-10 ECEA:1 CA:45x0.030 CL:8	0.250	1	0.005	190	38	None
End Milling (52 R, )	52	C-2 Carbide	AR:0 RR:0 ECEA:3 CA:45x0.030 CL:15	0.250	11/4	0.0015	50	78**	Soluble oilt (20:1)
End Milling (49 R <sub>c</sub> .)	49	T-15 HSS	RHH:35 CA:45x0.060 PC:6	0.250	3/4	0.001	55	70°°	Soluble oil Flood (20:1

<sup>\*</sup>Binegative

<sup>&</sup>quot; Total for all teeth

<sup>†</sup>Applied as mist through axis of cutter

Table 2—Recommended Cutting Conditions for Milling Hot Work Die Steel Vasco Jet 1000 Quenched and Tempered to 50-52 R<sub>C</sub>

	Workpiece Hardness. (Rc)	Tool Material	Tool Geometry (deg)				Cutting Speed (fpm)		Cutting Fluid
Face Milling	52	C-2 Carbide	AR:0 RR:-15 ECEA:5 CA:45 CL:8	0.100	2	0.005	125	80	None
Side Milling (down)	52	C-2 Carbide	AR:0 RR:-15 ECEA:5 CA:45 CL:8	0.100	13/4	0.0075	150	65	None
Slot Milling (down)	52	C-2 Carbide	AR:5° RR:10 ECEA:1 CA:45x0.030 CL:8	0.250	1	0.005	190	50	None
End Milling	9 52	C-2 Carbide	AR:0 RR:0 ECEA:3 CA:45x0.030 CL:15	0.250	11/4	0.0015	60	105**	Soluble oil (20:1)

Table 3—Recommended Cutting Conditions for Milling Austenitic Stainless Steel
A-286 Solution Treated and Aged to 321 Bhn

Milling Operation	Tool Material	Tool Geometry (deg)				Cutting Speed (fpm)		Cutting Fluid
Face Milling (down)	C-2 Carbide	AR:-4 RR:-11 ECEA:5 CA:45 CL:10	0.100	2	0.010	100	50	None
Face Milling	T-15 HSS	AR:0 RR:0 ECEA:5 CA:30 CL:8	0.060	2	0.015	50	55	Soluble oil (20:1)
Side- Milling (down)	C-2 Carbide	AR:10 RR:-5 ECEA:5 CA:45 CL:8	0.100	134	0.005	120	47	None .
Siot Milling (down)	C-2 Carbide	AR:10* RR:0 ECEA:1 CA:45x0.030 CL:8	0.250	1	0.005	150	30	None
End Milling	T-15 HSS	RRH:35 CA:45x0.060 PC:15	0.250	3/4	0.002	37	100**	Highly sulfurized oil and light machine oil (1:1)

<sup>\*</sup>Binegative \*\*Total for all teeth

<sup>†</sup>Applied as spray mist through axis of cutter

<sup>\*</sup>Binegative
\*\*Total for all teeth

# REFERENCE SHEET

the optimum cutting speed. These curves show that an increase in cutting speed of 20 percent can result in a 50 percent reduction in tool life.

### High-Temperature Nickel-Base Alloys

High-temperature nickel-base alloys usually contain about 40 to 65 percent nickel and 13 to 18 percent chromium. These alloys tend to work harden very readily and are extremely difficult to machine. In general, carbide is not recommended for milling because tools fail prematurely as a result of localized breakdown. More uniform tool wear and consequently longer tool life can be attained with T-15 high-speed steel tools. Cutting speeds should be quite low—20 fpm to 40 fpm for face milling. The

feed rate should be limited to about 0.005 ipt.

When end milling these high nickel alloys, feeds of 0.001 ipt to 0.002 ipt must be used. Feeds of less than 0.001 ipt should be avoided because of the high work hardening tendency of the alloys. Feeds greater than 0.002 ipt result in chipping and rapid tool wear. The recommended cutting speeds for end milling high nickel alloys are very low on the order of 20 to 30 fpm.

Recommendations for milling high-strength thermal-resistant alloys are listed in Tables 1 through 8. Various conditions such as tool materials and geometries, feeds and cutting speeds for these alloys are critical and hence deviations from those specified could lead to poor tool life.

Table 4—Recommended Cutting Conditions for Milling Austenitic Stainless Steel AISI 410 Quenched and Tempered to 45  $R_{\rm C}$ 

Milling Operation	Tool Material	Tool Geometry (deg)	Depth of Cut (in.)	Width of Cut (in.)		Cutting Speed (fpm)		Cutting Fluid
Face Milling	C-2 Carbide	AR:0 RR:0 ECEA:5 CA:45 CL:10	0.100	2	0.007	175	46	None
Face Milling	T-15 HSS	AR:0 RR:0 ECEA:5 CA:45 CL:8	0.060	2	0.005	70	50	Soluble of (20:1)
Side Milling (down)	C-2 Carbide	AR:0 RR:-15 ECEA:5 CA:45 CL:10	0.100	13/4	0.007	220	60	None
Slot Milling (down)	C-1 or C-2 Carbide	AR:5* RR:-5 ECEA:1 CA:45x0.030 CL:8	0.250	1	0.005	190	59	None
End Milling	C-1 Carbide	AR:0 RR:0 ECEA:3 CA:45x0.030 CL:15	0.250	11/4	0.001	120	100°°	Soluble oil (20:1)
End Milling	T-15 HSS	RRH:35 CA:45x0.060 PC:15	0.250	3/4	0.002	55	190**	Soluble oil

Binegative

<sup>&</sup>quot;"Total for all teeth

<sup>†</sup>Applied as spray mist through axis of cutter

Table 5-Recommended Cutting Conditions for Milling Precipitation Hardening Stainless Steel AM-350 Solution Treated and Aged to 444 Bhn

Milling Operation	Tool Material	Tool Geometry (deg)	Depth of Cut (in.)	Width of Cut (in )	Feed (ipt)	Cutting Speed (fpm	Approx. Tool Life (ipt)	Cutting Fluid
Face Milling	C-2 Carbide	AR:0 RR:0 ECEA:5 CA:45 CL:8	0.100	2	0.005	160	37	None
Face Milling	T-15 HSS	AR:0 RR:0 ECEA:5 CA:45 CL:8	0.060	2	0.005	65	70	Soluble oil (20:1)
Side Milling (down)	C-2 Carbide	AR:0 RR:-15 ECEA:5 CA:45 CL:8	0.100	13/4	0.010	120	50	None
Slot Milling (down)	C-1 or C-2 Carbide	AR:5 RR:-5 ECEA:1 CA:45x0.030 CL:8	0.250	1	0.003	120	63	None
End Milling	T-15 HSS	RHH:35 CA:45x0.060 PC:15	0.250	3/4	0.002	70	150**	Soluble oil (20:1)

\*Binegative \*\*Total for all teeth

Table 6—Recommended Cutting Conditions for Milling High-Temperature
Nickel-Base Alloy
Udimet 500 Solution Treated and Aged to 360 Bhn

Milling Operation	Tool Material	Tool Geometry (deg)	Depth of Cut (in.)	Width of Cut (in.)	Feed (ipt)	Cutting Speed (fpm)	Aporox. Tool Life (ipt)	Cutting Fluid
Face Milling	T-15 HSS	AR:10 RR:10 ECEA:5 CA:45 CL:10	0.060	2	0.005	25	26	Soluble oil (20:1)
Side Milling (down)	T-15 HSS	AR:10 RR:10 ECEA:5 CA:45 CL:10	0.060	134	0.010	21	25	Soluble oil (20:1)
Slot Milling (down)	C-2 Carbide	AR:5° RR:-5 ECEA:3 CA:45x0.030 CL:12	0.125	1	0.005	100	27	None
End Milling	T-15 HSS	RHH:35 CA:45x0.030 PC:12	0.250	3/4	0.002	30	54**	Soluble oi (20:1)

\*Binegative \*\*Total for all teeth

Table 7-Recommended Cutting Conditions for Milling High-Temperature Nickel-Base Alloy Inconel 700 Solution Treated and Aged to 320 Bhn

					9			
Milling Operation	Tool Material	Tool Geometry (deg)	Depth of Cut (in.)	Width of Cut (in.)	Feed (ipt)	Cutting Speed (fpm	Approx. Tool Life (ipt)	Cutting Fluid
Face Milling	T-15 HSS	AR:10 RR:10 ECEA:5 CA:45 CL:10	0.060	2	0.005	25	37	Soluble oil (20:1)
Side Milling (down)	T-15 HSS	AR:10 RR:10 ECEA:5 CA:45 CL:10	0.060	13/4	0.007	25	22	Soluble oil (20:1)
Slot Milling (down)	C-2 Carbide	AR:5° RR:-5 ECEA:3 CA:45x0.030 CL:12	0.125	1	0.005	100	20	None
End Milling	T-15 HSS	RHH:35 CA:45x0.030 PC:12	0.250	3/4	0.002	30	90**	Soluble oi (20:1)

Binegative Total for all teeth

Table 8—Recommended Cutting Conditions for Milling Cobalt-Base Alloy HS-25 Solution Treated to 209 Bhn

Milling Operation	Tool Material	Tool Geometry (deg)	Depth of Cut (in.)	Width of Cut (in.)	Feed (ipt)	Cutting Speed (fpm)	Approx. Tool Life (ipt)	Cutting Fluid
Face Milling	T-15 HSS T-15 HSS	AR:0 RR:10 ECEA:5 CA:45 CL:10	0.060	2	0.005	37	27	Soluble oil (20:1)
End Milling		RHH:35 CA:45x0.060 PC:15	0.250	3/4	0.001	30	70*	Soluble oil (20:1)

"Total for all teeth

# Honor Awards Winners......130 1960 Annual Report......133-141 Members Push Standards Plan......142 Members in the News......143 Chips and Chatter.....144 Chapter News......146-153 Chapter News Index.....146

ASTME Progress Award Ralph J. Cordiner



ASTME Engineering Citation Edward E. Griffiths



Joseph A. Siegel Memorial Award Frank Martindell

# Honor Award 1960 are

A GREAT DEAL of reflection and study goes into the yearly selection of the ASTME National Honor Awards winners. This task belongs to the National Honor Awards Committee, consisting of nine of the Society's past presidents. Staffing the 1959-60 committee are Otto W. Winter, chairman; Ray H. Morris, Albert M. Sargent, Irwin F. Holland, Robert B. Douglas, Herbert L. Tigges, Jacob J. Demuth, Leslie B. Bellamy and Roger F. Waindle.

Again this year the study and reflection on the part of the National Honor Awards Committee have resulted in the selection of a half dozen men, each an outstanding exponent in one of the six-award categories represented. A seventh honor of equal stature, the Eli Whitney Memorial Lecture Award, was conferred by the committee this year on Allen V. Astin, director of the National Bureau of Standards.

Presented at the Honor Awards Dinner during the ASTME Engineering Conference in Detroit, appropriate medals and citations, describing each winner's achievements, were accepted by:

The 1960 Progress Award went to Ralph J. Cordiner, chairman of the board, General Electric Co. The winner of this award must have distinguished himself in the field of manufacturing processes, methods or management. Cordiner qualifies in all three areas. Affiliated with GE since 1923, except for a 1942 stint with the War Production Board in Washington, he was appointed the firm's president in 1950 and elected chairman of the board eight years later.

General Electric's organizational structure based on the theory of "decentralization" has been Cordiner's primary and personal contribution to the development of better manufacturing methods and practices. Under this concept manufacturing engineering is recognized as a distinct function of management. Assigned groups have measurable responsibility for research, innovation and development in the manufacturing engineering area. In other words, to stimulate creative achievement and self-development, responsibility for decisions is placed nearest to the scene of action.

Cordiner's conviction that innovation in both products and processes is the key to a company's growth and prosperity has resulted in the establishment of such things as GE's Manufacturing Services Lab, where manufacturing processes and automation equipment are developed and improved; more than 70 development laboratories with similar functions in operating components; the Specialty Control Dept., responsible for the development of automatic controls for machine tools; and the Methods and Time Standards Service, which also supports re-

# Winners for Selected

search, training and consulting activities; extensive use of predetermined time standards, photographic techniques, work sampling and work simplification techniques; and long-range planning in all components so that manufacturing facilities planning can be accomplished in an orderly fashion in time to meet the requirements of the business.

With an established reputation for leadership in the design and application of high quality, reliable tooling and equipment, Edward E. Griffiths, consulting engineer, accepted the 1960 Engineering Citation. A past chairman of the ASTME Research Fund Committee and still assisting that group, Griffiths also handled the revision of the tool control section of the second edition of the Tool Engineers Handbook.

For 46 years he worked for Westinghouse in the field of tool engineering and its application to the manufacture of that firm's products. He pioneered in the use of tungsten carbide as a high-production die material. The promotion of plastics as a tool material for limited activities also had Griffiths' backing. He directed a plan whereby tool maintenance costs could be controlled by standardization. He established the use of reference data relative to tool standards of various natures.

Griffiths envisioned the use of electrochemical principles of tool material removal and promoted its applications to grinding of die surfaces. He urged manufacturers of such equipment toward practical development of its applications. Understanding the vital importance of proper heat treatment of tools and dies, Griffiths was influential in upgrading this occupation to an improved industrial stature. He has been a leader in the field of application of modern press design to industries' needs with particular reference to die design and the development of improved feeding mechanisms. Advancing the techniques in furnace brazing of tool steel components, particularly through encouragement of those engaged in early experiments in this field is another of Griffiths' accomplishments.

In recent years Griffiths has been a leader in the evaluation of ceramic cutting tools. While with the Society's Research Fund Committee, this award winner worked to establish punchability standards. To do this he organized and directed a united approach on the part of industry, press manufacturers and steel companies. His leadership and contagious enthusiasm in the field of tool design, development and application have inspired his tool engineering associates everywhere.

The JOSEPH A. SIEGEL MEMORIAL AWARD, presented for contributions through leadership, voluntary support and timely acts



ASTME Education Award Charles Stewart Mott



ASTME Gold Medal Edward C. Varnum



ASTME Research Medal Norbert Wiener

of benefit to the Society, went to Frank Martindell, consulting engineer. Working now as a consultant for the Chilean Steel Institute, Martindell has been residing in Santiago, Chile, since early 1958.

The holder of a master's degree in engineering, Martindell was a 1915 graduate of Cornell University. He joined ASTME in February of 1941, serving three terms as chairman of the Chicago chapter education committee and subsequently transferring to the Northern New Jersey chapter. He served on the National Education Committee and was a member of the 20-man national Board of Directors in 1944-45. He is now a member-at-large.

During a vacation trip to Chile, Martindell made a study of the engineering and metalworking fields in that country. He found a great lack of technical literature and engineering reference material. Since then he has been working closely with the Society and the Chilean Point Four group in supplying the necessary data to Chilean engineers. As a driving force behind ASTME's purpose of promoting and advancing scientific knowledge through writing and publishing, Martindell has earned the title "engineers' engineer."

Industrial leader, philanthropist and humanitarian all describe Charles Stewart Mott, president of the Foundation bearing his name, and winner of the Astme Education Award. Working for his father's firm, maker of wire wheels and rims for bicycles and carriages, Mott developed an interest in the automobile business. He began designing axles for vehicles and aided in the building of machines to produce them. As president of Weston-Mott Co., he made it the world's leading manufacturer of axles. When GM bought the firm Mott became a director of the corporation. Politics caught his eye eventually and he served three times as mayor of the city of Flint, Mich.

Regard for his fellow man soon led Mott to establish the Charles Stewart Mott Foundation. Through the foundation any adult may complete his high school education, study college credit courses, learn an art or craft, study languages, music, drama, sports, business, homemaking, or any of over 30 trade and industrial courses. Mott has worked closely with ASTME in conducting courses in engineering law and engineering fundamentals as part of the Saginaw Valley chapter's professional engineering registration program. Mott's interest in engineering education also prompted him to lend his financial assistance in the establishment of the University of Michigan's Flint Extension.

The head of operations research at the Barber-Colman Co., Edward C. Varnum, is the 1960 winner of the ASTME GOLD MEDAL. Besides his membership in the American Society of Tool and Manu-

facturing Engineers, Varnum is affiliated with the Operations Research Society of America and the American Society of Quality Control.

Majoring in mathematics at the University of Michigan, Varnum served as a teaching fellow at that school while he worked toward his M.S. degree. He was elected to Phi Beta Kappa and Phi Kappa Phi during his college career. After leaving U. of M., he taught mathematics and physics for two years at Hamline University in St. Paul, Minn., and spent one year at the University of Wyoming's department of mathematics as an assistant professor.

Varnum joined Barber-Colman in 1944 as a mathematical consultant. In 1950 he was promoted to the position he now holds. As head of operations research, Varnum has assisted top management in establishing policies and making decisions related to inventory control, machine replacement, order lot size determination, new building location, and other matters that lend themselves to mathematical analysis.

Varnum has contributed articles to a great many technical journals including The Tool Engineer. Equally as extensive is the number of papers he has presented before technical organizations throughout the country.

Qualifying for the 1960 ASTME RESEARCH MEDAL is Norbert Wiener, professor of mathematics at Massachusetts Institute of Technology. The word most closely associated with Dr. Wiener is cybernetics, defined by Webster's as the comparative study of mechanical-electrical communication systems, such as computing machines. Wiener is the inceptor of the word cybernetics and its theory.

The applied theory and mathematics of cybernetics has had a profound effect upon automation and its outstanding element of feedback. The impact of his research into electromagnetic waves and electromechanical communication and control systems upon business and industry has been incalculable. At the beginning of World War II Wiener developed the theory of prediction, smoothing and filtering of times series, as a consequence of which he was able to come up with the comprehensive concept of cybernetics. He is the author of a book bearing that name.

Wiener received his Ph.D. from Harvard in 1913. He also studied at Cambridge in England, at Göttingen in Germany and at Columbia University. His teaching career has taken him back to Harvard and Cambridge, to Tsing Hua University in Peiping, and to College de France. Included among his written works are The Fourier Integral and Certain of Its Applications, Harmonic Analysis in Complex Domain, The Human Use of Human Beings, and Ex-Prodigy, an autobiographical work.



AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

# **ASTME CHAPTERS**

# serve strategic industrial areas

- Racine
- Cleveland
- Milwaukee
- Chicago Fairfield County
- Hartford Pittsburgh
- Toledo
- Buffalo-Niagara Frontier
- Twin Cities
- Rockford
- 13 Baltimore
- Northern New Jersey
- Philadelphia
- Rochester St. Louis
- 18 Dayton
- Syracuse
- 20 Schenectady
- York
- Tri-Cities Elmira
- Worcester Toronto
- Los Angeles Golden Gate
- 29 Houston
- South Bend
- Peoria
- 32 Springfield (Mass.) 33 Boston
- 34 Greater New York
- Binghamton 36 Columbus
- Indianapolis
- 38 Grand Rapids
- 39 Seattle 40 Twin States 41 New Haven

- 44 San Diego 45 Fond du Lac
- 46 Portland (Me.)
- 48 Washington
- 49 Williamsport
- 50 Montreal

- 53 Little Rhody 54 Louisville
- 55 Windsor
- 57 Kansas City
- 59 (Inactive)
- 60 New Orleans (Inactive) 61 Atlanta 62 Erie
- 63 Portland (Ore.) 64 Springfield (III.)
- 65 Niagara District 66 Richmond
- 67 Phoenix
- 68 Saginaw Valley
- 69 Oakland County 70 Muncie
- 71 Cedar Rapids
- 73 Evansville 74 Mid-Hudson
- 75 Madison
- 75 Madison 76 Springfield (Ohio) 77 Denver 78 Mohawk Valley 79 Ann Arbor Area 80 Des Moines
- 81 Grand River Valley Piedmont
- 83 Lehigh Valley

- 84 Long Beach 85 Salt Lake City
- 86 Granite State
- 87 Jackson 88 Long Island
- 89 Greater Lancaster
- 90 Tulsa
- 91 London-St. Thomas 92 Los Alamos (Inactive)
- 93 Albuquerque 94 Peterborough 95 San Gabriel Valley
- 96 LaCrosse
- Lima
- 98 Santa Clara Valley 99 San Fernando Valley
- 100 Northern Massachusetts
- 102 Paterson
- 103 Nebraska 104 Louis Joi Louis Joliet
- 105 Memphis
- Tucson
- Knoxville-Oak Ridge Chautauqua-Warren
- 109 Lansing
- Muskegon
- 112 Calumet Area 113 Merrimack Valley
- 114 Hendrick Hudson 115 Western Reserve
- 116 Kalamazoo
- 117 Battle Creek 118 Southeastern Massachusetts
- 119 Santa Ana Valley 120 Benton Harbor-St. Joseph
- 121 San Antonio 122 Riverside
- 123 Little Rock

- 125 Oklahoma City
- 126 East Texas 127 Ashtabula County 128 Northwestern Pennsylvania
- 129 Centinela Valley
- 130 Monmouth 131 Elkhart-Goshen
- 132 Schuylkill Valley 133 Raleigh-Durham
- 134 Lorain County 135 Mansfield
- 136 Ottawa
- 138 Trenton-Delaware Valley
- 139 Ozark 140 Southeast Kansas
- 141 Mississippi 142 Macomb County
- 143 Birmingham
- 144 Sydney, Australia
- 145 Sacramento 146 North Shore
- San Francisco
- 148 Central Connecticut 149 Greater Halrisburg
- 150 Southeast Florida Catskill Region
- 152 Melbourne, Australia 153 Santa Monica Bay Acea 154 Lex naton

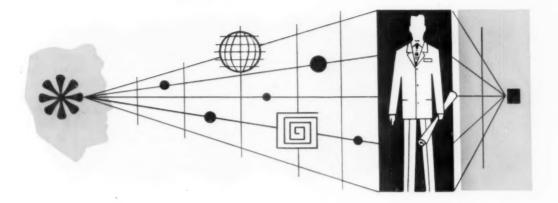
- 155 Bristol, Tenn.-Va 156 Ogden, Utah
- 157 Ithaca
- 158 Bradford-Olean
- 159 St. Petersburg
- 160 Orlando Mid-Pennsylvania
- 162 Southern Minnesota 163 Framingham
- 164 Greenville-Spartanburg 165 Manila
- 166 Mexico City

# ASTME STUDENT CHAPTERS

- 1 University of Michigan
- 2 Utah State University

Wentworth Institute

- University of Kansas Wayne State University
- 5 Alfred State Technical Institute 6 Purdue University
- 8 Franklin Technical Institute 9 City College of New York 10 Mohawk Valley Technical Institute
- 11 Lawrence Institute of Technology
- 12 California State Polytech. College
- 13 Canton Ag. and Tech. Institute 14 University of Wichita
- 15 Long Beach City College
- 16 Southern Technical Institute 17 Hudson Valley Tech. Institute 18 Rochester Institute Tech
- 19 Oregon State College 20 Sinclair College 21 Erie Co. Tech. Institute
- 22 State Tech. Institute 23 San Diego Junior College 24 Lowell Tech. Institute
- 25 Tri-State College
- 26 Ohio College of Applied Science 27 Pasadena City College
- 28 Gaston Technical Institute
- 29 McKeesport Campus, Penn State 30 Western Ontario Inst. of Technology 31 Muskegon Junior College



# Fellow Members of ASTME:

Soul-searching . . . . Taking stock . . . . Facing up to the facts of life . . . .

Take your pick, But whichever idiom you choose, it expresses what your Society has been doing this past year.

The time comes to each organization, just as it does to each man, when it becomes necessary to pause and look at itself in perspective. This evaluation of position is a sign of maturity—and the 28-year-old American Society of Tool and Manufacturing Engineers has indeed matured.

In this Annual Report, you will be impressed with the reaffirmations of purpose and practice and also with the improvements to the Society during the past year. Manlike, the Society has faced up to the complex challenges of the space age. The Society has even added to its name . . . .

Everyone likes to read about himself. That's why I am sure you will read this report closely, for you are the Society. As the organized embodiment of your scientific, technological and professional personalities, ASTME spends your money and exerts your energies for what the leadership interprets to be your needs.

Even though your financial position has not improved during the year, you have gained other benefits that will bear fruit in the future. The groundwork has been properly laid to provide a steady increase in all ASTME interests. Your Society is technically, morally and financially sound. I am proud to have served it.

Submitted for and on behalf of the Board of Directors and National Officers

Maque Eving

President and Chairman of the Board

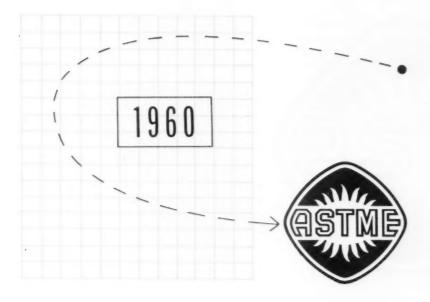


How MUCH DO YOU KNOW about the American Society of Tool and Manufacturing Engineers—the organization in which you, as a member, invest your time and money and energies?

Members have certain privileges, not the least of which is the privilege of asking questions and expecting answers. A concomitant characteristic of this privilege, however, is the obligation to know the answers.

If a nonmember were to ask you the questions listed below, how many could you answer? Just to be arbitrary, and to motivate you in this exam, let's say that if you can answer 12 to 15 out of the 15 questions, the nonmember will join the ASTME (provided he's qualified!) on the spot. If you can answer 9 to 11 of the questions correctly, the nonmember will say "Maybe." If you can answer only 8 or fewer, the nonmember will turn his heels to you. In other words, you will have flunked. Ready? (The answers, by the way, can be found elsewhere in this Annual Report.)

l.	When was the Society founded?	_
2.	Where?	
3.	How many senior chapters are there now in ASTME?	_
4.	In how many countries other than the United States are there chapters of the Society?	
5.	How many members are there on the national Board of Directors?	
6.	Who was the national president of the Society during the 1959-60 term?	
7.	How much salary do the national officers and directors draw from the Society?	
8.	What is the correct name of the Society's monthly magazine?	_
9.	Name the seven categories of membership.	
10.	With what committee is entrusted the Society's long-range planning?	
11.	Who decided whether the Society should add "Manufacturing" to its title?	
12.	How often does ASTME sponsor a national Tool Show?	
13.	What is the correct title of the 2289-page book which the Society published this past year?	
14.	How much per year does the Society disburse in its International Scholarship progam?	
15.	What is the total membership (within one thousand) of the Society?	



# a new name . . . SYMBOL OF PROGRESS

When the membership recently voted themselves a new corporate title, a patriarch of the Society who had religiously opposed any such name-changing nonsense thumbed the pages of his Old Testament and found some consolation in Proverbs 22:1. The verse—"A good name is rather to be chosen than great riches"—might be interpreted as particularly applicable, he reckoned, to a nonprofit organization whose riches consist mainly of traditions.

Whatever the interpretation, the Society's voting members heeded the proverb with an amazing show of democratic will. A 7½-to-1 majority said amen to the addition of "and Manufacturing" to their name—making it the American Society of Tool and Manufacturing Engineers. In retrospect, too, some could feel that they had gone the proverb one better: they had chosen a good name and at the same time had managed to keep all the rich heritage that the old one connoted.

Some 17,000 voted. This total represented better than 47 percent of the qualified voting members of the Society. Such an expression of opinion would be a statistical source of pride in any democratic organization. . . .

The story of the name change has the whole epic of the Society bound up in it. In vignette, it illustrates the Society's

- · Past-birth, growth, changes and challenges.
- Present—maturity and responsibility in a complex industrial society.
- · Future-strategic posture on the brink not only of

a new decade, the Sixties, but of a new age, the space age.

Not least, the mechanics of amending the name offers a lesson in democracy. It shows ASTME in action; it not only tells what makes the Society tick, but shows it ticking.

One Thursday evening 28 years ago, 33 engineers who represented a cross-section of Detroit's tool and manufacturing industry met to elect five of themselves as officers of the new American Society of Tool Engineers. Ever since that March 3rd, 1932, the members of the Society have been remarkably unified in purpose-and just as remarkably heterogeneous in title. Then, as now, only a relative few of the members have borne the title "tool engineer." Then, and even more so now, their job descriptions might be master mechanic, production supervisor, process planner, industrial engineer, tool planning supervisor, methods engineer or any other of many manufacturing and executive titles in use by modern-day industry. Whatever the title, though, the Society has traditionally been a closeknit and rapidly growing organization of "the only guys in the plant who can make it work or make something that will."

War and peace, boom and recession, automation, the atomic age, the space age have all served to underscore the relevance of the Society in modern industry. Just as life's horizons have broadened in a generation, so has the scope of the Society's concern. Perhaps the best barometer of the broad range of tool engineering and the broad interests of Society members is the editorial content of their national magazine, The Tool Engineer. Periodic and impartial research into readership preferences

determines this content. Although "tool engineer" in its narrow meaning is associated only with tooling, that field accounts for less than one-third of the engineering articles published in the magazine. Many others cover processes, materials, management, quality control and other categories of legitimate concern to practicing tool engineers. One hundred percent of the content, however, falls within the broader confines of "tool and manufacturing engineer."

Thus the addition to the name was, in essence, merely recognition of the facts of life. As your president expressed it at the time, "It is apparent that the expanded name keeps pace with the times and recognizes the foundation upon which the Society was organized, namely, the recognition of progress."

Amending the name, however, was no simple matter. Aside from the mechanics of effecting the change, there was opposition to overcome.

A dozen years of study and debate preceded the successful campaign last winter. A definitive opinion survey disclosed that more than half of 1601 members who replied to questionnaires felt that "tool and manufacturing engineer" more adequately described the duties and functions of Society members. Only a third of the respondents felt that ASTE was adequate. However, past efforts to change the name had been unsuccessful largely because the proposals involved dropping the cherished words, tool engi-

neer. The compromise proposal, containing both something old and something new, was offered in late 1959 by the Society's Long-Range Planning Committee, and quickly won enthusiastic backing.

Constitutionally, the following steps were necessary before the ASTME became official:

Signatures of 400 or more eligible voting members were obtained on petitions, which were checked and validated at Headquarters.

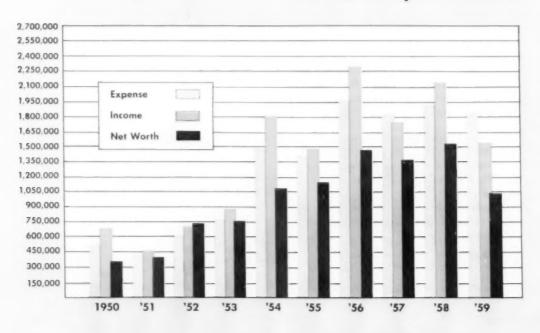
A majority of all chapter Constitution and Bylaws committees signified, by special mail ballot, their approval of a referendum on the proposal. The vote was 118 for, 12 against.

On Dec. 7, 1959, ballots prepared by the National C&B Committee were mailed to the voting membership, stipulating return within 30 days.

An official tally of the voting found that 14,929 members favored the addition to the name, 1969 disapproved. The Constitution provides that approval or disapproval of a referendum measure is decided by a majority of the votes cast; therefore, the new name was announced as official on Jan. 7, 1960, by the national secretary.

The Society's leaders are convinced that the new name will do a better job of conveying to industry, to educators, to the general public, and even to some of the Society's own members, the expanding function and importance of tool and manufacturing engineering in the space age.

# Society's Growth



# HIGHLIGHTS

# of the year

Membership, the keystone of the Society, has always been a source of pride both from the standpoint of quality and growing quantity. This past year was no exception, even though the Society reflected to some extent the imbalance that prevailed in the nation's economy.

ASTME rolls as of March 15, 1960, showed a total of 40,577 members. This total includes the seven categories of members: honorary, life, senior, junior, student, affiliate and associate.

Since the last Annual Report, the following senior chapters have been chartered: Bradford-Olean 158, St. Petersburg 159, Orlando 160; Mid-Pennsylvania 161; Southern Minnesota 162; Greenville-Spartanburg 163; and Framingham 164.

At the time this report was prepared, chartering of a new off-shore chapter at Manila, Philippine Islands, had been scheduled for April 25, with Past National President Harry B. Osborn, Jr., officiating. In addition, organizational efforts were near to bearing fruit in Mexico City and chartering of an energetic group there was tentatively scheduled for April, with retiring President Wayne Ewing conducting the ceremonies.

Manila and Mexico City increase the "inter-

national set" of the Society to 13 chapters. Nine are prospering in Canada and two in Australia.

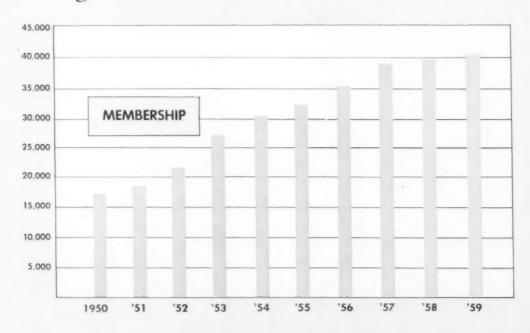
Eight student chapters were chartered during the year, bringing the total to 31.

Pride in its membership, however, has not blinded the Society's leaders to a problem. During the Fifties, the average yearly percentage of member dropouts in ASTME was 12.4. At the St. Louis Semiannual Meeting last fall, Vice President Dale Long labeled delinquency the Society's No. 1 problem. Resources of the National Membership Committee, and of the Society have been bent toward not merely getting the member but holding him.

Education is one way to hold the member. Increasing emphasis on ASTME's efforts to help both student and practicing engineers, both young and old, both members and nonmembers, has been recorded during the year. The 1959-60 series of Creative Manufacturing Seminars, sponsored by the National Education Committee and tailored to today's and tomorrow's needs of manufacturing men, consisted of 14 programs presented in key cities across the country. Last year there were only nine of these seminars.

The fundamental purpose of the Society, as set forth in the Constitution, is to disseminate knowledge in the science of tool and manufacturing engineering. Education, therefore, takes a back seat to no other activity in ASTME. It takes the form of hard cash in the International Education Award

# During the Fifties



# COST OF SERVICE PER MEMBER PER YEAR\*

(based on fiscal years 1957-58 and 1958-59)

Scientific and Engineering Expositions	\$ 4.29	
Conferences on Science and Engineering	1.90	
Reference Publications on the Science of Tool Engineering	1.97	
Periodical Publications on the Science of Tool Engineering	25.53	
Engineering and Educational Research	1.36	
Engineering Regulatory Research	.17	
Engineering Data Service	.51	
Technical Information Services	1.22	
Scientific and Engineering Program Planning	1.07	
Standards Research	1.01	
Awards for Science, Engineering, Research	.21	
Operations (Office; Finance, Judicial, Constitution and		
Bylaws activities; Officers and Directors)	7.91	
Membership Activity	.77	
	.33	
Seminars on the Science of Tool Engineering	.66.	
Seminars on the Science of Tool Engineering	\$48.25	_
		_
Total		_
Total  INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)		
INCOME PER MEMBER PER YEAR*	\$48.25	_
Total  INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)	\$48.25 \$ 6.56	
Total  INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)  Initiation Fees and Miscellaneous	\$48.25 \$ 6.56 1.42	
INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)  Initiation Fees and Miscellaneous  Scientific and Engineering Expositions	\$48.25 \$ 6.56 1.42 10.41	
INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)  Initiation Fees and Miscellaneous  Scientific and Engineering Expositions  Engineering Data Service	\$ 6.56 1.42 10.41 .49	
INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)  Initiation Fees and Miscellaneous  Scientific and Engineering Expositions  Engineering Data Service  Reference Publications on the Science of Tool Engineering	\$ 6.56 1.42 10.41 .49 .26	
INCOME PER MEMBER PER YEAR*  (based on fiscal years 1957-58 and 1958-59)  Dues (Includes Member Subscriptions)  Initiation Fees and Miscellaneous  Scientific and Engineering Expositions  Engineering Data Service  Reference Publications on the Science of Tool Engineering  Periodical Publications on the Science of Tool Engineering	\$ 6.56 1.42 10.41 .49 .26 26.58	

Total

\$46.73

The sound financial structure of the Society, with a net worth of a million dollars, is portrayed in the balance sheet on another page of this report.

\*Average membership during the period was 39,328

The above figures for income and expense illustrate the multiple dividends each member receives in addition to invaluable scientific and technical information. With an average dues payment of \$6.56 going to Headquarters (a portion of the original outlay for dues is returned to the chapters), each member receives services in various forms from the Society amounting to \$48.25, a return many times that of his investment in National operations.

The tables for income and expense are represented on a per member basis covering two preceding fiscal years in order to average the Expositions—heretofore held biennially—on an annual basis.

program. Twenty college-level scholarships totaling \$11,000 were given this past year to needy and able students who intend to make careers in manufacturing engineering.

**Books** are an important part of the Society's educational activities. ASTME published the equivalent of a whole shelf of them during 1959.

A veritable "shelf of books under one cover" is the Second Edition of the Tool Engineers Handbook, a 2289-page compendium of data on all phases of planning, control, design, tooling and operations in the mechanical manufacturing industries. The original handbook, published in 1949, sold over 76,000 copies, and until publication of the second edition was still considered the most authoritative work in its field. Important developments in tool and manufacturing engineering within the last decade, however, led the Society and its National Technical Publications Committee and staff to undertake the comprehensive revamping of its best-seller.

Suppliers Directory. Published last June as a 13th "bonus" issue of the members' monthly magazine, The Tool Engineer, the Directory is a comprehensive listing of manufacturers, their products and their local distributors. A survey of membership reaction showed that 94 percent of the respondents regarded the Directory as a timesaver, and that 63 percent had actually used it to facilitate company purchases. These and other statistics added up to an enthusiastic reception of the first Directory and justified the magazine staff's plans to publish a substantially expanded 1960 issue.

Tool Shows. Serving the interests of industry and of tool and manufacturing engineers are the mammoth exhibits that the Society sponsors. The 1960 Tool Show was expected to draw 530 exhibitors and an attendance of 35,000. The Detroit exhibit is the first on an annual basis; heretofore the national show has been held biennially.

The National Exposition Committee has announced that the Western Tool Show, held every other year, will be staged in November, 1960. The new Los Angeles Sports Arena, site of the Democratic National Convention in the summer, has been leased for the ASTME show. New York City's Coliseum will be the setting for the Society's national Tool Show in 1961.

Entrusted to a great extent with the ASTME's future is a hard-working—and unsalaried—group becoming known familiarly as the LRP's.

The LRP—the Long-Range Planning Committee—consists of the Society's national officers and national directors, both incumbent and elect, and the chairman of the National Constitution and Bylaws Committee. Under the permanent chairmanship of Past President George Goodwin, the LRP Committee has met four times during the year in its far-reaching study of the ASTME's why, how and wherefore. Their goal is to scrutinize the basic concepts of the Society in the context of the future; their approach is a line-by-line, step-by-step examination of aims, membership and government.

The addition to the Society's name was in great measure the result of LRP's careful assessment of ASTME's role in the age of space.

## BALANCE SHEET FEBRUARY 29, 1960

### ASSETS.

Cash\$	32,171.62
Treasury Bills	370,789.88
Accounts Receivable	25,978.22
Investment Funds	842,129.19
Inventories	98,584.37
Property and Equipment	246,448.33
Expenses Paid in Advance	22,270.50
Total Assets\$	1,638,372.11

### LIABILITIES AND NET WORTH

Liabilities:	
Unpaid Normal Expenses\$	46,184.35
Deposits-Future Business	539,506.50
Accrued Personnel Expenses	3,252.32
Unpaid Sales Commissions	1,659.75
Total Liabilities\$	590,602.92
Net Worth	,047,769.19
Total Liabilities & Net Worth\$1	,638,372.11

# Members Push Standards Plan

Several Society Members are backing an ambitious new proposal for user-builder agreements on general purpose machine tool standardization. Some of them were present, in key committee roles, at a March 22 session in Detroit when major users hosted representatives of 21 machine tool builders.

Results of the joint meeting, first of its kind, will be disseminated to all machine tool builders listed by the U. S. Department of Commerce. The users' proposals will be officially presented to the National Machine Tool Builders Association meeting in New York early this month. R. L. Witsche of the International Harvester Co., chairman of the users' coordinating committee, hopes that the builders—both members and nonmembers of NMTBA—will appoint a similar working committee to come up with their own proposals.

"After that, one machine at a time, we hope for

rapid adoption of the program with its important and mutual benefits to both sides," Witsche said.

Among members of his nine-man users' coordinating committee are ASTME members H. C. Daum of Ford Motor Co. and A. A. Herzberg of Waukesha Motor Co. A member of the users' drilling subcommittee is Duane H. Brighton of Caterpillar Tractor, who is chairman of ASTME's Finance Committee. Other Society members represented on users' committees include W. W. Gilbert of General Electric, on the grinding subcommittee, and H. Cooper of Chrysler Corp., on the milling group.

The users proposed the unification of tool mounting and related surfaces on standard machines employed in milling, grinding, drilling and turning. Included in their proposed standards are a universal descriptive nomenclature, uniform table heights and dimensions, uniform T-slot sizes and locations, uniform spindle taper applications and motor horse-power relative to machine size.

# Vital in National Emergency

Backers insist that the program will not influence design features peculiar to each builder's product, nor inhibit or restrict creative engineering developments. They stress that resultant interchange of tooling and fixturing will bring about economies in dollars and time and would be especially vital in the event of national emergency,

A guest at the Detroit meeting, Standards Administrator Arthur Colton of ASTME Headquarters, further pointed out during a press conference that such standardization with its curtailment of downtime and increased production would release engineers for more creative use of their time—would mean "more engineering per engineer" at a time when engineering manpower and talent are at a premium in this country.

Witsche assured Colton that the users' group would welcome Society and American Standards Association help in the program.

Others in attendance included E. M. Hicks of the Norton Co., vice president NMTBA, and John H. Williams of the Department of Defense. Williams pointed out that many machines bought for World War II and even Korean use are already valueless because of lack of standardization. "For the taxpayer's sake," he said, "the U. S. Government wants to buy equipment today that it can use tomorrow."

The General Purpose Machine Tool Standardization Group represents the following manufacturing industries: Aviation, electronic, automotive and truck, home appliances, highway construction equipment, commercial refrigeration, railroad, farm tractor and implement, marine engine, steel, glass, communication, photographic, plumbing and government ordnance, including tank and missile.



S. Paul Burns

# Members in the News

S. Paul Burns, Detroit chapter, for the past five years vice president and chief engineer of Pioneer Engineering and Mfg. Co., Inc., has been named executive vice president and elected to the board of directors of that organization. Burns, a registered professional engineer, joined Pioneer as a draftsman in 1936.

Walter B. Kiefer, vice chairman of the National Membership Committee, first vice president of the Lake Eric Regional Council, and past chairman of Pittsburgh chapter, has been promoted to general foreman of Fuel Processing Lab, Material Department at Westinghouse, Bettis, Pa.

MARGARET J. McGINNIS, executive manager of the Industrial Diamond Association of America, Inc., was the recipient of the Paterson chapter's Service Pin Award for the year. Mrs. McGinnis received the service award for her work on Standard B67, Diamond Dressing Tools.

A new sales engineering agency tailored specifically to New England industry, has been formed by DAVID M. GASKILL and WILLIAM T. NYSTROM, both members of Little Rhody chapter. Gaskill was sales manager successively for Cleveland Instrument Co., Brush Instruments, and Airborne Instruments Laboratory; and Nystrom, past chairman of Little Rhody chapter, was with Taft-Peirce Mfg. Co., and later served ten years with Brown & Sharpe Mfg. Co. The new agency, besides head-quarters at Cramston, R. L., will post sales engineers in Boston, Hartford and Albany.

G. Edward Trevaskis, charter member of the Hamilton Ontario chapter and member of the Detroit chapter since 1941, has joined Drillunit Inc. as sales manager. Trevaskis has been associated with tool engineering for over 20 years, and most recently was executive vice president of The Detroit College of Applied Science.

JOHN W. FOUTCH, Canton chapter, who joined Timken Roller Bearing Co. in 1949 as a tool engineer, has been promoted to project engineer, Production Development Div. Before joining the Timken Co. Foutch was employed as a sales engineer by Vascoloy-Ramet, a division of Fansteel Metallurgical Co. . . . Announcement is made of the retirement of ROLAND M. GARDNER of the North Shore chapter, manager of Equipment Development for Sylvania Lighting Products, a division of Sylvania Electric Products, Inc. One of the founders of the early Sylvania Products Co. of Pennsylvania, Gardner started his career as a master mechanic in its St. Marys, Pa., plant and during his 41 years with the company be developed and sold patents for much equipment for the manufacture of gas-filled lamps, tipless lamps and other lighting products. . . . WILLIAM A. JOHNSON, Detroit member, formerly connected with the Beaver Precision Products Co., has been elected president of the R-O Mfg. Co. . . . THOMAS E. CUSH-ING of Northern New Jersey chapter, was named assistant secretary of Orange Roller Bearing Co.



John W. Foutch



Roland M. Gardner

# Chips and Chatter

An extraordinary request for advanced registration, spelled out in neat English printing on an ordinary ASTME seminar registration form, was received in Headquarters a few weeks ago. The applicant wanted to attend the Dimensional Metrology Seminar scheduled for two days during the Detroit Engineering Conference and Tool Show, and the Metalcutting Seminar May 12-13 in Chicago.

Education Director Gilbert E. Seeley wrote back to the applicant—Ryonosuke Narutaki, dean of the Mechanical Engineering Department at Kobe University, Kobe, Japan—that ASTME would indeed feel honored to register him for the two seminars. In view of the applicant's stature and the number of statute miles involved, Seeley added that ASTME would absorb the registration fees in his case. In addition, would Narutaki be ASTME's guest at the Education Day program during the Detroit conference?

Headquarters personnel, at this writing, were looking forward to asking Narutaki one question: Where did he get the seminar registration blank?

QUOTE OF THE MONTH: "Have you ever seen a 2800-ton capacity press, 28 feet long and shipped in 80-ton sections, installed by hand labor? I have."-A. J. Hill, DETROIT chapter member who is now in India as superintendent of toolroom and tryout at the sprawling Hindustan Motors Ltd. plant near Calcutta. The plant produces 67 percent of the components that go into 40 trucks and 35 passenger cars daily. Hill, former Ex-Cell-O Corp. employee, told a touring delegation from the Greater Detroit Board of Commerce that "I just couldn't watch it when they installed that thing, but it works well now." He added: "We've been over here to help improve methods, production and quality. There's a Scotsman at the plant who gave me a name that really fits: technical coolie, grade one."

Among ASTME members enrolled in the Department of Commerce's National Defense Executive Reserve is Edmund A. Cyrol of Chicago chapter. Head of a consulting firm and a frequent contributor to The Tool Engineer, Cyrol joins some

1200 business and professional people across the country who have been recruited in recent months to staff the operation of a production agency in event of national emergency. Reservists take indoctrination courses at the several regional head-quarters of the Office of Civil and Defense Mobilization where they would be expected to report under combat conditions . . . Another ASTME member of the Reserve is Past President Harold E. Collins.

A live presentation of a labor-management arbitration hearing edified and entertained Long ISLAND chapter recently. Prepared by the American Arbitration Association, the drama cast John A. King as arbitrator; Joseph J. Mele as industrial relations director and Rolph H. Schweitzer as his assistant in the "Pennsylvania Boiler Works, Inc."; Edward Von Linden as USW international representative; Al Fuchs as the aggrieved worker; and William Bruning as a fellow employee. For arbitrator King there were three possible conclusions: to uphold Fuchs' dismissal by the company; to reinstate Fuchs with full back pay; to reinstate Fuchs without back pay. The ASTME audience was the jury. Both the arbitrator and the jury independently chose the third alternative, according to Editorial Chairman Warren A. Lipman.

Executive Secretary Harry Conrad accepts an award for ASTME's "outstanding service" to the Junior Engineering Technical Society, from Richard T. Fallon, executive director of JETS. The handsome bronzed plaque, mounted on polished walnut, was presented during the JETS' Eastern leadership conference held recently at Republic Aviation Corp., Farmingdale, N. Y. In further recognition of the Society's help at both the National Education Committee amd chapter levels, Conrad was elected to the JETS Board of Directors. Among ASTME guests at the JETS conference were immediate Past Chairman Sheldon Meyers and Editorial Chairman Joe Mele of LONG ISLAND chapter, and Education Chairman Lou Wertman of the ASTME GREATER NEW YORK chapter.





The steering committee of the Manila chapter met recently to plan the chapter's course of action now that it is part of ASTME.

Pictured among this group of engineers is Telesforo Velante (third from right), prime organizer of the new chapter.

#### Manila

### International Ranks Increase

By the time this magazine reaches its readers one, perhaps two, outside-the-U.S. chapters will have become part of ASTME. April 25 was the date set for the chartering of Chapter 165 in Manila, Philippine Islands. And pending the approval of the National Board of Directors, April was also expected to be the month in which a group of tool and manufacturing engineers in Mexico City gain official Society recognition.

ASTME came to Manila mainly because of the efforts of one man, Telesforo V. Velante. Velante is general manager of Velante Engineering & Manufacturing Co. After a two-month membership campaign more than one hundred engineers signed up for Chapter 165. A survey of local industry indicates a potential membership of no less than 400.

The Filipino Society members are being drawn from electronics, automotive parts, tool and general metal industries; from hardware fabricators and manufacturers, engineering companies and machine shops. De La Sulle College in Manila is also providing eight fourth-year mechanical engineering students for the membership roster.

Past President Harry B. (Doc) Osborn, Jr., was expected to conduct the April 25 chartering.

#### Mexico City

The Mexico City group has been operating for quite a few months. Tool and manufacturing engineering is still in the infant stage in Mexico and this proposed chapter has been working diligently to provide Mexican engineers with information that might modernize Mexican production.

One method the Mexico City group has found useful in the orientation of their fellow engineers is

the monthly technical meeting. Their March gathering attracted over 100 persons.

Retiring President Wayne Ewing had agreed to install the new officers of Chapter 166 sometime in April, if the chapter had fulfilled requirements for a charter. Sparking the Mexican ASTME movement have been John Bailleres, former Houston chapter chairman who is now working as a tool engineer for Perforadora Latina, manufacturer of oil field tools and tractor parts; Julio N. Garcia, a field engineer for Amertool Services, Inc.; and Ray A. Gast, vice president of that firm.

With the chartering of the Manila and Mexico City chapters the Society's "international set"—chapters located in countries other than the United States—will have increased to 13. ASTME already has nine chapters in Canada and two in Australia.



Members of the proposed Mexico City chapter examine parts of the machinery used to illustrate a talk on "Electrical Discharge Machining." The talk, presented by Ray A. Gast, vice president of Amertool Services, Inc., was the highlight of the group's March meeting.

# chapter news

## index

Atlanta	19
Calumet	18
Cincinnati	18
Columbus	52
Des Moines	18
Erie	51
Grand Rapids	47
Greater New York	53
Hamilton District	53
Ithaca	52
Kalamazoo	5/2
Keystone	53
London-St. Thomas & District 1!	50
Long Beach14	47
Louisville1	51
Macomb	
Madison1	
Mid-Hudson 1	50
Monmouth	
Nebraska1!	
Northern Massachusetts	
Paterson	
Pittsburgh	53
Purdue 1	
Racine	
Saginaw Valley	
Santa Ana Valley	
Southern Minnesota	
Springfield (Ohio)	51
Tucson	
Twin Cities	
Twin States	
Windsor	45
Worcester	
	_



TWIN CITIES—The new officers of Chapter 11 discuss that ASTME group's future with William Moreland (seated, left), national vice president and installing officer at the March meeting. Listening to Moreland's comments are (standing, left to right) Frank Liljemark, second vice chairman; Orville Wineland, treasurer; Arthur J. Stockwell, first vice chairman; and Roy Wressell, secretary. Seated beside Moreland is the new chairman, George Minarik.

—Ed Gillaspy



MACOMB —A workhorse of the Society, E. Wayne Kay proudly accepts an Award of Merit—one of 14 in the ASTME this year—from Leslie B. Bellamy, past national president and general chairman of the Detroit Host Committee for the 1960 Engineering Conference and Exhibit. Looking on is Macomb chapter's outgoing chairman, Herbert E. Hiser. Kay, former chairman of Detroit chapter and a prime organizer in 1955 of the Macomb group, received the award "for his balanced contributions to the Society's growth" at Chapter 142's installation program recently. He is a section chairman of the host committee.

#### Purdue Conference Scheduled May 14

The 1960 version of the Society's oldest on-campus conference series has been scheduled for Saturday, May 14, at Purdue University. The theme will be "Scientific Applications for Tool and Manufacturing Engineers."

Plans were made final at a recent meeting of the sponsoring Indiana-Kentucky-Western Ohio Council of ASTME. Technical discussions will cover such topics as report writing, vibration isolation of high-speed mechanical presses, impact forging, numerical control, radioisotope utilization in industry and principles of radiation safety. An evening lecture will cover peacetime applications of the atom.

Exhibits and demonstrations at the engineering campus in Lafayette, Ind., will include carbide tooling, radioisotopes, tool wear, leak test, thickness gages, safety devices and others.

Roy E. Erickson of the Indianapolis chapter is the chairman of this ASTME area council.

#### Chapter 68 Holds Installation and Tour

SAGINAW VALLEY-ASTME Executive Secretary Harry E. Conrad installed the officers of Chapter 68 at the March meeting. In his talk before the 130 members and guests present, Conrad said that it is only the active participation of the membership that makes the Society a success. Without the personal effort of the individual member the ASTME would not be possible nor as effective as it is. Installed as officers of the Saginaw Valley group were James Elliott, chairman; Elmer Mieskowski, first vice chairman; Robert Elliott, second vice chairman: Roger Locher, third vice chairman; Michael Skunda, secretary; and Donald McMillan, treasurer,

The spotlight fell on Elliott not only for his installation as chapter chairman. He was also the host of a tour through the AC Spark Plug Div. of General Motors Corp., where he holds the position of director of production engineer-

The group toured the toolroom and the instrument manufacturing departments of AC. A new tape-controlled jig boring machine and the latest type kellering machine were viewed in the toolroom. In the production area the members and guests saw automatic diecasting machines, impact extrusion presses and an integrated assembly line technique. The technical chairman for the meeting and the tour was Norman Lawless, manufacturing development engineer at AC.

—A. P. Lind

#### Six Engineering Educators Heard at Madison Meeting

MADISON—Chapter 75 is doing its best to keep in step with the United States' accelerated program to educate the country's youth. Realizing the need for more highly trained engineers and specialists, the forward looking members of this ASTME group are doing something about it.

To do their part the chapter set out to stimulate interest in tool and manufacturing engineering among the young people in the Madison area who have displayed talent in this direction. Invitations to attend the February meeting, the annual education night, were extended to local students and their advisers. Some 25 persons accepted.

Madison's February program consisted of a panel discussion conducted by six professors of engineering, among them Kurt Wendt, dean of the University of Wisconsin's engineering school. The instructors were all specialists in different fields of engineering—civil, mechanical, electrical, and chemical. Thus the students were confronted with the whole picture, not just an explanation of what is happening in one field.

When the time arrived for audience participation the experts on the panel were bombarded with queries from the students and their advisers. The number and intelligence of the questions put to the panel members assured the Madison members that "Operation Stimulate" had been a success.

-Joseph E. Markvart



These 17 young men, all of whom show talent in the field of engineering, were in attendance at the Madison chapter's February meeting. The education night program was aimed at arousing the students' interest, especially in the field of tool and manufacturing engineering.





#### Also Pins . . .

LONG BEACH—Outgoing Chairman Irvin P. Also pinned down a pair of his fellow chapter members at the March meeting. In the top photograph he presents the new chairman's pin to Lyman Allen, who will head Chapter 84 for the coming year. Below, Paul J. Bodnar, chapter editorial chairman, receives the service award pin from Also in recognition of his numerous contributions to, and in behalf of, the chapter.

-Paul I. Bodnar

#### Grand Rapids Chapter Stages Joint Meeting

GRAND RAPIDS—"Quality Control versus Tooling" was the topic of a February panel discussion between members of the two societies most directly concerned with these subjects. Chapter 38 of ASTME and the local chapter of the American Society for Quality Control met jointly for the discussion.

On the panel, which was moderated by Grand Rapids chapter chairman, Edwin Stouten, were Robert V. Gane. quality control manager at National Waterlife Co.; John G. Rutherford, assistant quality control manager at Lear, Inc.; William Zoellmer, assistant plant manager at Lear, Inc.; and Vern Markley, stamping engineer at Grand Haven Stamped Products.

-Ray Kutschinski

#### Glass Expert's Talk, Officer Installations, Cincinnati Highlights

CINCINNATI—A film entitled "Time and Space," officer installations and a talk on "Glass, an Engineering Material" comprised the major part of Chapter 21's March meeting. Some 75 members and guests were present.

The first item on the program was the film which dealt with the planning, building and firing of rockets and missiles. Following this was the swearing in of the officers by a past chairman of Cincinnati chapter, Joseph Maezer. The new chapter executives are Chairman Frank Houston, First Vice Chairman Frank Kutz. Second Vice Chairman Joseph Williamson, Secretary Val Anzalone, and Treasurer Norman Ahlgrim.

Houston performed his first official duty as chairman when he introduced the speaker for the evening. George W. McClellan, coordinator of the technical information service of Corning Glass Works. In his discussion of glass as an engineering material. McClellan pointed out the many types of glass and the steps necessary in their manufacture. The members were surprised to hear that glass is capable of withstanding prolonged operation at temperatures as high as 1900 F or, while still red hot, an abrupt plunge into ice-cold water. Other compositions have the ability to selectively transmit or absorb chosen bands of radiant energy. Mc-Clellan also stated that products made from glass can be as light as cork in some cases or as strong as cast iron in -Clarence Keller

# Diamonds in Industry Discussed at Hamilton

HAMILTON DISTRICT—After his summary of some of the Society's longrange plans, including a mention of the work being done in conjunction with the government of the Province of Ontario to obtain recognition for ASTME, National Director Bruce Fairgrieve installed the new slate of officers.

Following the installation, guest speaker R. Parsons of The J. K. Smit Co., Ltd., was introduced. "Diamonds in Industry" was the title of his presentation. He began by discussing single-point tools and the care used in selecting diamonds for these tools. Parsons then touched briefly on specially shaped diamond tools for dressing thread grinding and forming wheels. He told of diamond lapping powders that are available in a wide range of micron sizes for such things as polishing dies.

—G. Bryant



DES MOINES—Pinning the award service pin on Fred Doolittle, former chapter bulletin editor and new treasurer of Chapter 80, is outgoing Chairman Walter Cocks. Doolittle was installed at the March meeting along with Jesse L. Howe, chairman; Bernard Beall, Jr., first vice chairman; Zellis Zeller, second vice chairman; and Merl Schillerstrom, secretary.

—Dick Eppings

#### Director Enumerates Society Benefits

TUCSON—Sixty-five officers, members and their wives enjoyed the dinner and installation of officers Mar. 12.

The advantages of membership in ASTME were emphasized by National Director G. Ben Berlien, who installed the new officers. He spoke at considerable length regarding educational opportunities the local chapters and the national organization have to promote civic assistance and leadership, and enumerated the tools by which this education can be carried on. These, he said, included the national publications -THE TOOL ENGINEER, Tool Engineers Handbook, Die Design Handbook, technical papers-as well as the activities of local chapters at the high-school level. These would include the formation of student chapters; the national scholarship awards; and the activities of local chapters. -G. H. Moritz



RACINE—George Strombeck, chairman of Chapter 2's scholarship committee, introduced Ralph Ludwig at the March meeting. A graduate of the University of Wisconsin, Ludwig is the first student to complete his college work with the help of a Racine chapter scholarship.

-Paul R. Tiles

#### Numerical Control Here To Stay, Says Chicago Specialist

CALUMET—"Not just a 'gimmick' but an essential part of progress in today's competitive manufacturing"—this is how Ralph W. Drayer, program control specialist at the General Electric Co., Chicago, described automatic control systems. Drayer made this statement at Calumet chapter's February meeting.

Over one hundred members discovered, through Drayer's talk, the new concept of tape-controlled machines and the fundamentals necessary to achieve the ultimate-a fully automatic controlled machine tool. Tape, Drayer demonstrated, is not just a theory, but an established fact which is not only accepted by the majority of machine tool manufacturers, but is now in existence and can be purchased by those companies possessing the necessary foresight and application for this new adaptation. Numerical control, he said. will be to the low-volume manufacturer what automation has been to the automotive plants and other high-volume industries. It will be a means whereby setup times, ordinarily having a highcost factor when related to present-day labor costs, can be almost eliminated.

Capital expenditures for this type of equipment are rather high, the speaker admitted, and many difficulties will be experienced when analyzing and trying to justify the introduction of this type of control. Savings are not apparent at first, but eventually many functions will be condensed to process engineering practices and performed by an office clerk with the necessary automatic typewriting equipment.

Numerical control systems are now becoming fairly standardized, Drayer stated, and the standard 1-inch, 8-channel tape is being accepted by the majority of companies applying tape control. This lends itself to effective standardization of controls for dissimilar machine tools and is the first step in reducing the cost of machine tool equipment.

Certainly there are going to be "bugs" to eliminate and this process of elimination will undoubtedly fall on the shoulders of the tool engineer, Drayer continued. This will be just another challenge to the versatility of his skill. Whatever the reaction when first confronted with this type of control system, Drayer concluded, it is fairly certain that numerical control is here to stay, and digital and analog computers, binary coding, data processing and three-coordinate drafting will soon be accepted as common shop-floor terminology.

-James T. Reece



Kenneth Peters, mechanical engineer at Electronics Associates, Inc., instructs a group enrolled in the Monmouth chapter's new "Shop Math Review Course." Peters, a member of Chapter 130, was one of the organizers of the night-school course.

#### Manufacturer Describes U. S. Influence Abroad

SANTA ANA VALLEY—The president and the production foreman of Weatherby, Inc., makers of rifles and gun scopes, were the guest speakers at a recent meeting of Chapter 119. Roy Weatherby and Fred Jennie, in explaining how the company manufactures its products, touched on the subjects of metallurgy, deep-hole drilling and other processes necessary in this manufacturing. Viewed by the members was a special rifle made by his firm and used by Weatherby in shooting a world-record polar bear,

In his world travels, Weatherby told the ASTME audience, there is one fea-

ture that stands out in every country. whether it be on the European continent, in Asia or in Africa. That feature is the "American influence." American products are everywhere, in the form of automobiles, airplanes, farm equipment, and road equipment. Technicians sponsored by the U.S. Government-called "government missionaries" by Weatherby-are teaching people in other countries how to do things the way we do them, thus raising the standard of living. Some 120 Santa Ana Valley members were on hand for the Weatherby and Jennie presentation. -Leroy G. Connelly



WINDSOR—March guest speaker J. Lynch (second from left), sales manager of the milling machine division of The Cincinnati Milling Machine Co., discusses his presentation with (left to right) outgoing Chairman Bert Underwood, National Director Bruce Fairgrieve, and new Windsor Chairman Don Rail. Fairgrieve also installed Ray Smith, first vice chairman; Dennis Swan, second vice chairman; Ed Drayton, third vice chairman; Ed Aldous, secretary; and Bert Ruiter, treasurer. —Frank Shaw

#### Shop Math Review Course Offered At Monmouth

MONMOUTH—Chapter 130's educational activities have been centering around one project of late, their new "Shop Math Review Course." The course was organized by Erick Hanson, chairman of the chapter professional development committee; Emil Petach, education committee chairman; and Kenneth Peters, who teaches it.

Presently there are 32 persons enrolled in the ten-week course, 29 men and three women. Costs for the class, which is being held in the New Jersey High School in Middleton Township, were held to a minimum in order to encourage enrollment.

The course reviews math from fractions through natural trigonometry functions, use of the sine bar, charts and graphs, use of logarithms, and rectangular to polar coordinates. So far the interest of the students has been extremely high. Suggestions have been made to extend or append this course with others on descriptive geometry and the use of slide rules.

The course is not restricted to ASTME members, but advance announcements sent out by Chapter 130 warned that because the number of registrants would be limited "members would get first preference." As a result, the Monmouth chapter enrolled six new members who filed their membership applications at the same time they registered for the course.

—E. Noris

#### Past Chairman Dies

ATLANTA—Elmer D. Dattler, member of Atlanta chapter since July 1956, died here recently. Dattler, who served on committees and as chapter chairman in Atlanta at one time, left that city to set up his own business in Calhoun Falls, S. C.—"Tooling, Inc." He was 50 years old.

#### Twin States

At the Feb. 10 meeting approximately 40 members heard R. P. Jackman of the Small Aircraft Engine Dept., General Electric Co., speak on the principles of clear, understandable speaking and writing. He stressed the fact that it is not what you say—it is what they hear that counts in one of the world's biggest problems, communication—the bridge to understanding.

Following Jackman's talk, William Taul, Jr., of the Robert E. Morris Co., showed a film, "The Millers that Use Their Heads."

#### T. W. Black Speaker At London-St. Thomas Father and Son Night

LONDON-ST. THOMAS AND DIS-TRICT-THE TOOL ENGINEER'S senior associate editor, T. W. Black, covered a lot of territory on his recent visit to Canada. In a single day he addressed 90 technical students at the local Clarke Road High School and 150 more at Arthur Voaden Vocational School, telling the students of the functions of a tool engineer and the advancement opportunities available in the tool engineering field. Chapter 91's outgoing chairman Howard Wright, who accompanied Black on these excursions, presented the first school's library with an ASTME Die Design Handbook. The Arthur Voaden school library received both a Die Design and a Tool Engineers Handbook.

In the evening Black spoke of the new developments in tool engineering before the Father and Son Night audience of the London-St. Thomas and District chapter. The installation of new chapter officers also took place at the meeting. National Education Committee member, William Dawson from Hamilton, Ont., performed the swearing-in ceremony. The new officers are W. F. Graham, chairman; W. H. Brannan, first vice chairman; R. H. Pugsley, second vice chairman; Norman Champion, secretary; and R. M. Cornish, treasurer.

An added highlight of the March meeting was the presentation of handbooks to the libraries of G. A. Wheable Collegiate Vocational School and H. B. Beal Technical Commercial High School. A Tool Engineers Handbook also went to a drafting student from Beal Tech, Robert Pickell, rated the most proficient student in the school's technical program.—Louis Jensen, Jr.

#### Springfield, Ohio

Sixty-five persons were present at the dinner meeting Mar. 8, followed by a plant tour of Vernay Laboratories. Many new and interesting processes in connection with the rubber molding, which is the company's product, were shown. New officers were sworn in by Howard Volz, past Columbus chairman and past member of National Board of Directors.

Chapter 76 is undertaking a new project this year—cooperating with the local Junior Achievement Co.—by giving awards to outstanding junior achievers who have contributed most to the engineering, planning, processing and producing of their products.



THE TOOL ENGINEER'S senior associate editor, T. W. Black (left), watches as outgoing Chapter 91 chairman, Howard Wright, presents a Tool Engineers Handbook to Robert Pickell. To the right of Pickell, who is the top technical student at Beal Tech, is W. A. Golding, technical shop director at the school.



Feb. 27 saw the formation of a new area council—the Mississippi Valley Area Council. Pictured at the meeting are (left to right) Jesse Howe, chairman of Chapter 80, which played host to the group; James Mercer of the Nebraska chapter, council chairman; Lee Utiger, also of the Nebraska chapter and council secretary-treasurer; and Walter Cocks, past chairman of the host chapter.

—Dick Eppings



MID-HUDSON—National Director Joseph L. Petz (left) installed the new officers at Chapter 74's March meeting. The officers, all of whom except Cavalieri are IBM employees, are (left to right) Adolph W. Rzant, second vice chairman; Daniel R. Sabia, first vice chairman; Vincent J. Cavalieri, chairman; Armin A. Finger, secretary; and John C. Luhmann, treasurer.

—Armin A. Finger



Jacob J. Jaeger (center), president of Pratt & Whitney Co., Inc., delivered a talk on the advantages of numerical control at the February meeting of Chapter 76. Flanking him on the left is R. C. Montanus, president of Springfield Machine Tool, who acted as toastmaster, and on the right, Chapter Chairman J. Norman Dye, Urbana Tool & Die Co. Executives from local metalworking industries were in attendance.



WORCESTER—Eleven of Chapter 25's past chairmen gathered for a meeting held in their honor this February. Posing for this somewhat historic photograph are (seated, left to right) John C. Lalor, A. T. Warman, John T. Rotchford, Carl D. Schofield, Carl L. Morse: (standing) Daniel Hoyt, Ralph E. Rawling, Dr. Leo P. Tarasov, Adam Kosciusko, and Ralph A. Baker. Not pictured is Victor H. Ericson. —Roger Erickson



LOUISVILLE—Congratulating the men he has just installed as the officers of Chapter 54 is outgoing Chairman Earl Klein. Shaking hands with Klein is the new chairman, William Exely. Next to him are F. J. Wlodarek, first vice chairman; G. A. Mercer, second vice chairman; W. A. Bishoff, Sr., secretary; and Sam Gleaves, treasurer.

-Thomas R. Coffey

#### Numerical Control Called Economic Weapon By P. & W's President

SPRINGFIELD, Ohio — Some 184 members heard Jacob J. Jaeger, president of Pratt & Whitney Co., Inc., discuss the economics of numerical control at the Feb. 9 meeting, Jaeger won the 1959 ASTME Engineering Citation for his pioneering work in numerical control as applied to the metalworking field.

Jaeger stressed the vital role being played by numerical control because of today's high production requirements and close tolerances. The time-consuming elements of human error and decision making are all but eliminated as a result of the process. Once data are computed and introduced into the machine, Jaeger said, the machine will repeat its process over and over without error.

Economy in tooling is another advantage brought about by numerical control. The need for numerous and complicated jigs and fixtures is greatly reduced, thus cutting expensive tooling costs and saving valuable floor space ordinarily used for tool storage.

Jaeger added that the increased accuracy achieved by numerically controlled equipment results in large savings in man hours at final assembly time. With this process data are accurate and final. "There can be no mistakes," the speaker stated emphatically.

Summing up, Jaeger spoke of numerical control as an important weapon in our current economic war with Russia. The Soviet Union, with its knowledge of machine tools and production and practically no overhead costs for material or labor, is in a very good position to flood the world market with low-priced machinery. The savings on time and cost and the greater accuracy provided by this new digital controlled system could be our biggest asset in this noncombative, but equally deadly, economic war now being waged.

-Donald W. Thacker

#### Erie

At the Mar. 1 meeting, with 55 members and guests present, William Sherbrooke, national sales engineer for Templet Industries, Inc., in his talk on "Nature and Application of Steel Rule Dies in Modern Industry," emphasized the great savings that can be realized in the missile industry by the use of steel rule dies. It is a new tool, Sherbrooke said, that should be made available to industry to help meet foreign competition. New officers were installed by H. V. Loeppert, national secretary.

#### special events .

Steering Committee Metal Stamping Project	May 12, '60	Syracuse University Syracuse, N. Y.
8th Annual On-Campus Con- ference "Scientific Applications for Tool and Manufacturing Engineers"	May 14, '60	Purdue University Lafayette, Ind.
ASTME Western Tool Show	Nov. 14-18, '60	Memorial Sports Arena Los Angeles, Calif.



PATERSON—ASTME Executive Secretary Harry E. Conrad (third from right) was on hand to install Chapter 102's officers for the new term. Conrad is shown here with the officers and guest speaker Conrad Corsini, secretary-treasurer of Independence Plating Corp. Left to right are Joseph Marraccino, treasurer; Jacob Zandstra, Jr., secretary; William Jorge, third vice chairman; Corsini; Joseph Jowett, chairman; Conrad; Al Quintavella, first vice chairman; and John Saccone, second vice chairman.

# Film Depicts Growth Of Aluminum Company

KALAMAZOO—A technical machining specialist for Kaiser Aluminum & Chemical Sales, Inc., Ded M. Blott, was the guest speaker at Chapter 116's February meeting. Blott, who deals primarily with rod, bar and wire products, prefaced his oral discussion with a film on the origin, development and expansion of the firm he works for.

Beginning with the purchase of an abandoned government surplus aluminum plant, the company progressed until they were in possession of their own strategically located, ultramodern plants. The film also depicted Kaiser's development of an operation for open ore mining of bauxite in a foreign country and in creating an entirely new refinery in the Gulf area in order to overcome the difficulties in refining this particular grade of ore.

Kalamazoo members saw an unusual conservation method employed in the mining process. The topsoil was stockpiled and then replaced so that farming could be carried on after the land had been mined.

Impressive to the ASTME audience, both as tool and manufacturing engineers and as Americans, was the example of free enterprise that the film depicted.

—Don Massey

# Grinding Wheel Experts Heard

NORTHERN MASSACHUSETTS— Two subjects—"Grinding Structures and Residual Stresses" and "Solutions to Several Field Grinding Problems"—were covered by a pair of speakers representing the Bay State Abrasive Products Co. at the February meeting.

Albert L. Ball, technical consultant for the firm, appeared first. Associated with the abrasive industry for 35 years, Ball spoke of the physical structures of grinding wheels. He pointed out that the purpose of grinding is to establish dimension and finish. By the use of color slides he illustrated the different structures and compositions of various grinding wheels.

Covering the second topic, Robert I. Belmont, New England district manager of Bay State Abrasives, pointed out a number of grinding problems that have arisen in the field and how they were solved. It has been found that by the use of sulfur, grinding time on particular jobs has been drastically reduced and finish greatly improved. Belmont also revealed that not always does the problem lie with the grinding wheel. Sometimes the machine operator, insufficient horespower, job setup or even the machine itself is to blame.

-Richard I. Edwards

#### VTOL Aircraft Developments Told At Ithaca Meeting

ITHACA—Approximately 181 members and guests of Chapter 157 attended the March meeting to observe the installation of the new officers by National Vice President Dale Long and hear a talk on vertical take-off and landing aircraft by Donald E. Ordway, head of the aerophysics section, Advanced Research Division of Therm.

Following the installation the new chapter chairman, Donald Gibson, introduced guest speaker Ordway, VTOL or vertical take-off and landing vehicles include those with rotor, propeller, ducted prop, and jet lifting elements. Just as in the early days of conventional aircraft. Ordway stated, there are a multitude of other possible configurations, each having its advantages and disadvantages. The future of operational VTOL aircraft depends essentially on two factors. The first is the continued development of more powerful and lighter air-breathing engines of thrustto-weight ratios from 10 to 15. The second factor is the development of adequate understanding of the associated aerodynamic phenomena. Most of the VTOL problems will not yield to the mathematical simplifications which were generally possible for conventional aircraft. In the case of VTOL much more complex analyses are required.

Using color slides and film, Ordway traced the development of vertical takeoff and landing aircraft from the earliest contraptions to the most recent vehicles. He summed up with a tribute to early inventors here and abroad whose experiments paved the way for modern engineers in designing and constructing these unusual craft. —Anna B. Gage



COLUMBUS—Introducing guest speaker Dr. Harry B. Osborn, Jr. (right), past president of ASTME and district manager of the Tocco Div. of Ohio Crankshaft Co., is Chapter 35 Chairman Carl J. Winkleman. At the February meeting, Osborn discussed "Tooling for Induction Heating."

—Wayne A. McCulty

#### Engineer Sketches Plastics History At Keystone

KEYSTONE—George Macindoe, plant engineer at Consolidated Plastics Corp., chose "Modern Plastics Application in Building and Manufacturing" for his subject at the February meeting.

Macindoe briefly sketched the history of plastics and the application of various grades and types. He set up for display completed plastic parts, some of which were household utensils made from a superpolyethylene which has a considerably higher tensile and melting temperature.

His discussion regarding dimensional stability of plastics disclosed that molded parts retained their stability, but when a machine cut was taken and the skin broken certain types absorbed moisture, causing the part to grow. Also of interest to the Keystone members was a 1000-hole thermosetting programming board with a thermoplastic outer frame. This is made possible because of the higher temperature resistance of thermosetting resins as compared to the melting temperature of the thermoplastic rim. Die-casting rims on programming boards are being replaced by this process.

Die costs for some programming boards run as high as \$25,000, due to high quality of pins, pin breakage and microbole drilling. The diemaker was once just a skilled toolmaker, Macindoe concluded, he is today a highly skilled technician with artistic ability.

-William Brennan

#### George H. Mertz Dies

PITTSBURGH—George H. Mertz. 54, works manager of Robertshaw Thermostat Div., Robertshaw Fulton Controls Co., died here recently. Mertz was active in Pittsburgh chapter, of which he had been a member since 1941.

#### **Hamilton District**

At the regular monthly meeting Feb. 12, with 50 members and guests present, a panel consisting of four members, S. R. Palmer, John M. Snyder, K. W. Lemmond and A. Chalmers, with George Churchill as moderator, discussed the manufacture of air cylinders. A complete study of marketing, costs, profits, etc., was presented, along with all the steps necessary before the manufacture of this item.

The Award of Merit was presented to George Churchill, chairman of the constitution and bylaws and honor awards committees, for untiring devotion to his chapter and to the Society as a whole.

#### positions

#### available

TOOL ENGINEER—with manufacturing experience in cutting fluids. Young mechanical engineering graduate preferred. Attractive growth potential with nationally recognized Eastern U.S. oil refiner expanding into new field of activity. State background, education, experience and salary requirements. Write to Classified Ads, Dept. 175, 10700 Puritan Ave., Detroit 38, Mich.

COLLEGE INSTRUCTOR—engineering machine shop. Applicant should have a bachelor's degree plus industrial experience. Please send resume to Dean of Engineering, California State Polytechnic College, Kellogg Campus, Pomona, Calif.

MACHINE TOOL SALESMAN—Further expansion of S & S Machinery Co. provides top opportunity for first-rate sales engineers. Write S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y.

#### wanted

MANUFACTURING AND COST ENGINEER—with industrial engineering and cost estimating background; experienced in machining processing, cost estimating of automotive and aircraft parts, assemblies and tools. Journeyman toolmaker with jig and fixture building, gage making and production tool trouble shooting experience. Have written articles in magazines. Write Raymond O. Andrews, 16733 E. Eight Mile Rd., East Detroit, or call PRescott 7-9725 or LOgan 2-3000, Ex. 4995.

MANUFACTURING VICE PRESIDENT—graduate M.E. with 25 years of organizing to lay out plants, process, tool, time study, control, procure, inspect. Experienced in producing trucks and crawler tractors. Thorough machine shop, sheet metal, welding, assembly knowledge. Wants challenging position. Write to Classified Ads, Dept. 174, 10700 Puritan Ave., Detroit 38. Mich.

#### Chapter 11 Plans Seminar

TWIN CITIES—Chapter 11 will sponsor a day-long seminar entitled "Metal Forming for Tomorrow's Manufacturing" on Tuesday, May 10.

The seminar, scheduled at the Hotel Curtis, will be the first such educational venture of the Minneapolis-St. Paul chapter, according to Education Chairman Roy L. Groves. —Ed Gillaspy

#### Southern Minnesota

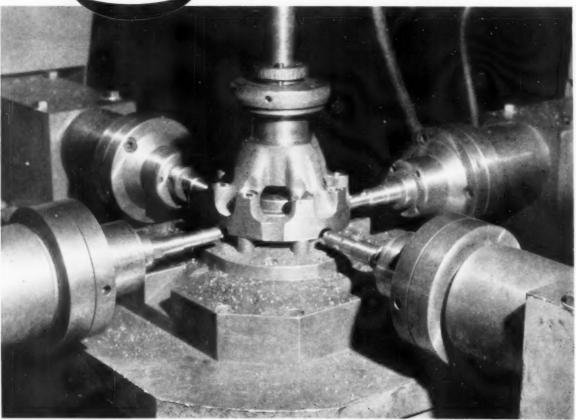
Glen Stimson, chief engineer for Greenfield Tap & Die Co., was the featured speaker at the Feb. 4 meeting. Sixty persons heard Stimson explain the importance of the millionth part of an inch to industry in mass-production techniques. His talk was augmented by slides and actual demonstrations of the effect of gage errors on products.



GREATER NEW YORK—At a meeting at which Malcolm F. Judkins of the Sylvania-Corning Nuclear Corp. discussed missiles and hypersonic aircraft material problems, new chapter officers were also elected. Pictured here they are (seated, left to right) Dominic R. Scolaro, chairman, and Alfred M. Sampter, first vice chairman. Standing are S. Frederick Seeman, secretary; Joseph A. Papa, treasurer; and Gerald Abbott, second vice chairman.

—Alfred M. Sampter





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The job is rough and finish boring half holes in a C5 steel forging. The machine is a 4 way Cross Bore operating at a speed of 2360 rpm and 700 sfpm; with a feed of .005 and a .025 to .030 depth of cut.

VR-65 tips are brazed to boring tools by conventional methods.

On this interrupted cut, VR-65 produced from 80 to 100 pieces per grind as compared to 10 to 25 pieces by previous conventional tungsten-base carbides.

VR-65 is the first of a new generation of carbides to provide ultra high speed machining on *all* types of steel . . . see your V-R representative for details or write:



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The Tool Engineer

# Progress in Production

#### PLASTIC REPLACES WOOD IN DIE MODEL FABRICATION

Substantial savings in time and money have been made possible with a new plastic paste material which effectively eliminates use of mahogany in fabrication of die models. Developed by Creative Industries of Detroit, the new technique reduces time requirements of model making by as much as 30 percent.



Master model being constructed of plastic. Unfinished half is made symmetrical to finished half with use of templates taken from finished portion.

First step in application of the technique begins when the customer provides a full size styling clay model. A plaster or plastic female mold is taken from the model in sections convenient to separate. The female molds are repositioned around a stacking cube which is positioned on a surface plate relative to established body lines. Plastic paste is then applied to the female surface and to webbing around the stacking cube. This provides a relatively finished duplicate of the stylized clay model.

One half of the model is then splined to the exact surface specified by Styling and Engineering, after which two sets of templates are removed. One set is delivered to Engineering so that interior structures can be designed while the other set is used to reproduce the approved surface onto the opposite side of the model. The result is a perfectly symmetrical, dimensionally stable master model.

Of special interest to model makers is the ability to use this plastic to build individual duplicate die models from a master model. By fencing off each panel perimeter, model makers can make female molds from which duplicate plastic models can be made. Other applications of the plastic are checking fixtures and drill jigs which can be quickly and inexpensively produced.

#### PASTE USED TO CASE-HARDEN STEEL

By applying a fused overlay of abrasion-resistant paste to the flights of a screw type conveyor, Industrial Machinery Co. of Fort Worth, Texas, has increased conveyor life approximately 550 percent. The development, perfected by Industrial Machinery and proved through extensive laboratory and field testing programs, has led to an entire new line of blue steel helicoid screw conveyors.

The hard-surfaced conveyors are especially well suited to conveying applications involving materials which are abrasive by nature and normally cause rapid flight wear. Typical food industry



Surface hardened conveyor flights. Hard-surfaced flights last five to six times life of unhardened surface.

applications are soy beans, pellet type processed feeds and similar free flowing abrasive materials. Other typical materials for which the hard-surfaced conveyor screw is recommended are alumina, bauxite, cement, cinders, coke, ground brick and slag.

Procedure in producing abrasion-resistant units begins with a standard screw mounted in a rotating fixture. The paste, a suspension of pure chromium boride hard-surfacing c-ystals produced by Wall-Colmonoy, is applied in a thin, even coat to the wearing surfaces of the conveyor flights. After application, the

paste is allowed to air dry. When thoroughly dry, it is fused to the base metal by applying an oxyacetylene flame to the paste-coated surface as the screw is rotated in the fixture.

Unlike most hard surfacing methods, paste application is not truly a build-up process, since build-up is limited to a few thousandths. The part to which paste is applied becomes hard-surfaced as a result of the alloying of its base metal with the paste. Penetration into the base metal is usually two to three times the applied paste thickness.

# SPRING TECHNIQUE IMPROVES HEAT TREATMENT OF SHEET STOCK

Spacer springs of die steel that minimize distortion in thin-gage aluminum sheets during heat treating have been developed by Clayton Ruud and Don Heinrich, manufacturing research engineers of the Boeing Aero-Space Div. Made of H-11 die steel the springs retain their tension through hundreds of heat treat cycles. Inserted at top and bottom of coiled thin-gage aluminum sheets, the springs are first stretched to facilitate coil placement. Tension is then released to fix the coil firmly for heat treat processing to the strength and dur-



Application of die springs to sheet before heat treatment. Ability of springs to withstand effects of furnace temperatures enables them to be reused.

ability required for high-performance

In several months of production, the

#### Progress in Production

springs have been found easy to apply and economical to use. Space provided by the springs between the coils insures uniform heat distribution and quenchwater circulation.

Use of spacer springs in this way has helped solve a thin-gage aluminum sheet heat-treat problem which has been troublesome in aircraft manufacturing. By restraining the coiled sheets during heat treating and, at the same time, preventing metal-to-metal contact, the technique has helped to prevent warp-

age, weak spots, whip-lash damage and lowered mechanical properties. These occurred variously during development tests in which the sheets were suspended from overhead clamps or placed upright on heat-treat racks in loose or tied coils.

# LOW CARBON STEEL REDUCES COST OF NUCLEAR REACTORS

Preliminary studies conducted by General Electric and United States Steel Corp. indicate that inexpensive carbon and low-alloy steels may be practical for use in nuclear power plants. Substitution of these steels for stainless steels will result in substantial savings in capital equipment and should do much to close the narrowing cost gap between nuclear power and conventional steam plants.

The studies show that in a boiling water reactor environment, corrosion rates of carbon and low-alloy steel remain remarkably low. This is the result of a protective oxide film which forms on the steels and inhibits corrosion.

Economic and technical gains to the nuclear industry resulting from use of carbon and low-alloy steels include: lower material cost, lower thermal expansion and i m proved heat transfer characteristics; greater availability; larger number of manufacturers with experience in carbon-steel fabrication; less serious radioactivity problems from corrosion products; elimination of stress corrosion eracking problems in some reactor designs.

#### RETAINING RINGS IMPROVE DESIGN OF DIFFERENTIALS

Dynamic Gear Co., Inc., Amityville, N. Y., has improved the design of its precision differentials and achieved substantial production economies through redesign of fastening methods. The com-



Redesigned differential, below, utilizes retaining rings to eliminate collar assembly shown above.

pany produces solid and hollow-shaft differentials which are used in electronic computers, missile guidance systems and other electronic and electromechanical applications.

Through the use of two Truarc Series 5100 miniature retaining rings, manufactured by Waldes Kohinoor, Inc., accuracy of the differentials has been increased and the tumbling circle of the spider gear shaft reduced for better miniaturization. It has also been possible to eliminate costly parts and machining operations while achieving an assembly time savings of approximately 97 percent. Savings with the rings

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#### Progress in Production

amount to \$3930 per 1000 units.

In the original design, the bearings were retained with set collars and set screws. Because the screws did not provide the positive lock required to maintain the backlash tolerance, holes were drilled through the collars and shaft on each side and the parts staked with dowel pins. The press fit required for the dowel pins often caused distortion of the shaft.

In addition to lowering costs, the retaining rings provide two important design advantages in that they permit shortening of the spider gear shaft and reduction of size and weight of the gear assembly. Use of the smaller shaft, with thin rings replacing bulky set collars, decreases the tumbling circle of the spider gears-a critical factor in miniaturizing both the differential itself and assemblies in which the unit is used. Reduction of size and weight of the spider gear assembly lowers the moment of inertia of the gears around the axis of the input and output shafts. This provides greater uniformity in gear revolutions and increases the accuracy of the differential.

#### SEAM TRACER CENTERS ELECTRODE

Electronic seam tracing device, produced by The Weldma Co., automatically causes the electrode of a welding torch to follow a seam regardless of mismatches in the workpiece. Any deviation of the electrode from the seam results in an error signal. Amplified electronically, the signal is transmitted to a servo motor which returns the electrode to the cen'er of the seam.



Welding torch in operation. Servo keeps electrode centered on seam.

This device is useful in such blind welding jobs as internal welding of missile cases. In this application the torch can be placed some distance from the seam at the start of a job. When an arc is struck, the torch moves immediately to the seam, staying on it until the weld job is completely finished.

#### SMALL MASS SPECTROMETER HAS HIGH SENSITIVITY

A new laboratory analytical mass spectrometer developed by the Analytical and Control Div. of Consolidated Electrodynamics Corp., a subsidiary of Bell & Howell Co., compares favorably with its substantially larger predecessor in accuracy and sensitivity. The 21-130 mass spectrometer is a revolutionary departure from CEC's 21-103C, the three-ton descendant of the first commercial mass spectrometer built by CEC in 1942 to analyze the constituents of various gases and liquids.

Because the 21-103C has a greater mass range it is expected to remain preferred for some laboratory applications, but the 21-130 will compete in many applications. Mass ranges of the 21-130 are m/e 2 to 4, 5 to 11, and 12 to 230 continuous with unit resolution at m/e 200. (The usual definition of resolution does not apply to a cycloidal focusing mass spectrometer. Unit resolution here is defined as having less than 1 percent cross talk between adjacent peaks of equal height.) Changing from one mass range to another is accomplished by merely flipping a switch.

Servicing of the spectrometer is facilitated by a "break away" cabinet which can easily be removed.

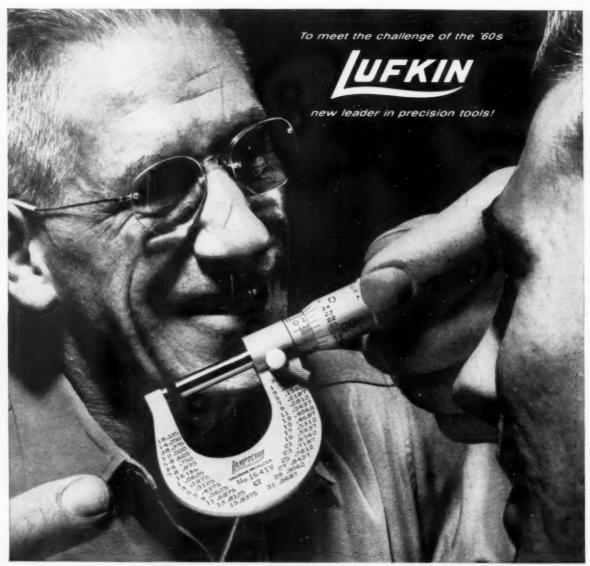
#### AUTOMATION UNIT ADAPTS PRESSES TO TRANSFER FEED

A versatile automation unit manufactured by Press Automation Systems, Warren, Mich., converts any single-action press into a transfer feed press. Compact and economical, the unit will feed strip stock or parts into and out of press die areas automatically. It can feed material between dies in a press or transfer and feed two or more presses in a line.

In operation, the unit bolts on the press bolster plate and can be moved from one press to another to provide automation for job-lot pressroom operations. Cast aluminum construction reduces weight and inertia forces of the unit.

Air cylinders operating through ball bearing linkages control all movements of the unit. In a typical operating sequence, fingers on parallel horizontal arms on the unit move toward each other to grip the part. Next the arms advance the part into the next die station. Then the part is released and the arms retract to start position. One or more pairs of fingers mounted on the arms in accordance with the number of operating stations effect part transfer.





\*The fabulous '60s, with tremendous technological advances predicted, will require this type of perfectionist precision tool . . . and, son—

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# TOOLS

# of today

#### Table Type Boring Mill

Redesigned and improved, the Wotan table type boring mill has a 3½-inch main spindle with a boring depth of 31½ inches and a large table and saddle. The model has optional reading attachments for positioning of the



spindle head, cross table and outboard, adapting it to a wide range of boring, milling, facing and thread cutting applications. The spindle sleeve has built-in, double row cylindrical roller bearings mounted directly in the spindle head housing. The mill provides 21 spindle speeds, 9 through 1000 rpm, and 27 feeds, 0.001 through 0.500 inch. The rotary table can be manually or power operated. A four-stop retractable index bolt provides accurate positioning of the table top with T-slots either parallel or under right angles to the center line of the spindle. Component movements are read on a capstan dial. Head feed and table cross feed are simultaneously operable, independently reversible, and combined for a feed motion that is inclined 45 deg in either direction. Spindles with diameters of 3.  $3\frac{1}{2}$ ,  $4\frac{1}{2}$  and  $5\frac{1}{8}$  inches are available.

Index Industrial Corp., 660 Madison Ave., New York 21, N. Y. Circle 401

#### Subland Drills

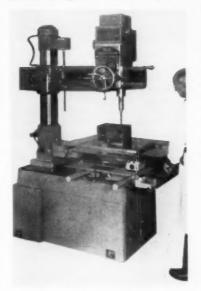
Three basic operational types are included in a line of standard subland

drills: a drill-chamfer for regular, fluteless, pipe and coil-insert taps; a drill-counterbore for socket-head capscrews; and a drill-drill for tap drill and body clearance on bolts, studs and screws. The drills are available in all practical sizes and combinatians, in three step lengths and three shank styles.

Mohawk Tools, Inc., 920 Main St., Montpelier, Ohio. Circle 402

#### Universal Angle Worktable

Designed for heavy drilling loads, this 18 x 24-inch tee-slotted worktable indexes 45 deg either side of horizontal.



Tee slots on the side provide clamping surface for overhanging workpieces, and a vee slott provides means of clamping round pieces and shafts. Cradle construction provides high rigidity.

Veet Industries, 25753 Groesbeck Hwy., E. Detroit, Mich. Circle 403

#### Plug-In Feeder

Open-back inclinable presses can be automated by this plug-in feeder unit which mounts on the side of a press, transferring small parts to the die from an operator-fed, preload station located out of the die area. Parts are removed



from the die by air ejection or other unloading means. Part pickup is done with vacuum-lift, electromagnets or gripper fingers. Any of the three saddle-mounted, interchangeable pickup arms can be provided for any unit. The feeder is installed by bolts to an adapter plate. Press cycling limit switches are provided.

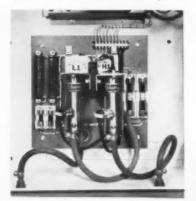
Press Automation Systems, Inc., 25418 Ryan Rd., Warren, Mich. Circle

#### Spike Power Welding

Resistance welding jobs that formerly demanded large welding transformers can now be done through a control and power system that uses transformers only a fraction of the size ordinarily required. The system utilizes a new type of tube called a coaxial ignition tube contactor. The tube is capable of handling very high peak currents for short time periods without misfiring or breaking down. The system generates minimum heat between pulses, leaving

#### TOOLS of today

welding electrodes virtually cold. Temperature of the workpieces is confined to the interface contact area of the two metals. Since little latent heat is left in the parts, they can usually be handled with bare hands immediately after

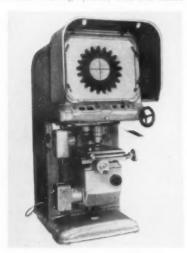


welding. With proper electrode contour, condition and pressure, minimized weld marks can be achieved, reducing need for final metal finishing.

Robotron Corp., 21300 W. Eight Mile Rd., Detroit, Mich. Circle 405

#### **Optical Comparator**

Illumination brilliance and edge-toedge sharpness are provided in the 18 x 22-inch screen of this optical comparator. The 5A, which has a telecentric four-lens turret, provides a twomotor focusing system, with one motor



for fast-motion course focusing and the other for fine focusing. Both motors are instantly reversible, and cutout microswitches at the extreme travel limits of the carriage automatically shut off the motors. Facilities for surface and contour measurements and inspection are provided. Additional equipment includes cross-moving and revolving micrometer stages, holding fixtures, protractor screens, charts and photo accessories.

Nikon, Inc., 111 Fifth Ave., New York 3, N. Y. Circle 406

#### Double-Plate Indexing Machine

Double overhead tool plates for the mounting and actuation of tools are employed in this turret indexing machine chassis. Developed for high speed, automatic assembly and processing operations, the machine provides positive parts control, reduced jamming potential, tooling accessibility and tool standardization. The center-mounted



plates move up and down with relative motion and are cam-actuated in synchronization with the main indexing cam shaft, mechanically timing and interlocking work transfer and tool actuation. Tools are center-mounted, facing outward, and provisions are made to permit feeding and escapement of parts as well as probing and orientating. Additional tooling can be mounted on external brackets around the turret and mechanically actuated.

Swanson-Erie Corp., 816 E. Eighth St., Erie, Pa. Circle 407

#### Deep Hole Drilling Machine

Flexibility, simplicity of setup and economical production are advantages of this revolving drill type deep hole drilling machine. It provides capacities from ½ to 1 inch with a 12 or 24-inch feed stroke; spindle speeds and feed rates suitable for a wide range of work; rapid advance and return; vertical and longitudinal positioning with calibrated



handwheel and crank to one-thousandths of an inch; 28-inch longitudinal, 12-inch transverse and 12-inch vertical travel; and a high-pressure coolant unit that delivers up to 30 gpm and up to 2000 psi, with filtering capability of 5 to 10 microns, built-in heat exchanger, and reservoir. Optional equipment, fixturing and accessories are available.

Machine Tool Div., Brown & Sharpe Mfg. Co., Providence 1, R. I. Circle 408

#### Induction Heating Unit

Operating at approximately 400 kc and 4 mc, this dual frequency 10 kw output, high frequency, induction heating unit is especially suited to research and development work and production of semiconductor and other conductive metals. The totally enclosed unit has power input of 230/460 volts, three phase, 60 cycles. Other voltages and frequencies are available. Power consumption is 20 kva maximum at 90 percent power factor. Power for the type



6320 water-cooled oscillator tube is obtained from six industrial type 575-A mercury vapor rectifier tubes employed in a three phase, full wave rectification system. Filament voltages are automatically controlled. Water consumption, at full load, is 6 to 7 gpm at 80 F.

Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill. Circle 409

#### Hydraulic Presses

Pressures of 25 and 40 tons are available in two electrically powered hydraulic presses. The unit illustrated, HP-25-E22, of 25 ton capacity, is



equipped with a 2-hp motor and has a ram speed of 28 ipm at no load and 12.2 ipm at full load. Ram speed of the 40-ton press is 17 ipm at no load and 8 ipm at full load.

American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn. Circle 410

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#### Setting Rings, Disks

Class XXXX master setting rings and disks, made to tolerances as fine as five millionths of an inch, are furnished in A.G.D. and Precisionaire styles. They are used to calibrate high-amplification air gages and other precision measurement instruments, permitting classification of parts in increments of less than five millionths of an inch.

The 0.125 to 0.825-inch rings and disks have accuracy of 0.0000025 inch. Accuracy of the 0.825 to 1.000-inch setters is 0.0000035 inch.

The Sheffield Corp., Dayton 1, Ohio.

#### Magnetic Shaft Position Encoder

Utilizing changes in the magnetic induction of toroidal ferrite readout cores to generate two-level voltage signals, the digitizer illustrated resolves a varying function, shaft angle, into discrete values, digits. The signals are generated by patterns on a ferrite disc as the input shaft rotates them past the readout cores. The binary-coded seventrack pattern shown can resolve a shaft revolution to one part in 128. One or

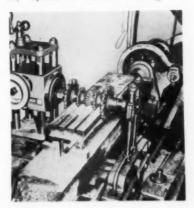


more readout cores, depending on the binary code used, monitor each bit track. The basic 7-bit encoder can be operated at 10,000 rpm. Larger encoders, the 13, 17, and 19-bit models, are restricted to speeds of approximate 1y 4000 rpm. The noncontact magnetic technique eliminates need for mechanical adjustment of encoder elements during the operational life of the encoder, expected to exceed 20,000 hours. In machine tool applications, encoders are used to feed back information on table positions, rate of movement and similar data.

Librascope Div., General Precision Inc., Glendale, Calif. Circle 412

#### Portable Milling Units

Unit sizes 1 and 3 can be attached to any standard machine tool for secondary operations without moving the



workpiece. The milling units can be used independently in fixtured setups since power and feeds are built in. Model 1, for small work, has a metal removal rate of ½ cu inch per min in mild steel, and can be mounted on lathes 10 inches or larger. Model 3 (illustrated), for large work, removes metal at 1½ cu inch per min in mild steel with lathe mounting of 18 inches or more. This model has an outboard arbor support accessory which, when used with an extended arbor, permits heavy straddle milling and other machining at a greater distance from the tool face.

The Dumore Co., 1300 Seventeenth St., Racine, Wis, Circle 413

#### Surface Grinder

Model 612 surface grinder has automatic forced lubrication, a direct drive



motor and a choice of right or left-hand longitudinal feeds as standard equipment. Grinder operation and maintenance are simplified by these construction features.

Harig Mfg. Corp., 5757 Howard St., Chicago 48, Ill. Circle 414

#### High-Power Spring Tester

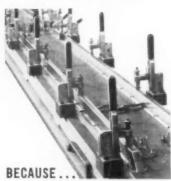
High precision testing of large compression and extension springs can be done with this motor driven tester which uses a heavy pendulum hung on knife edges. Capacity of the unit is ½ to 550 lb, with spring lengths up to 20 inches, spring diameters up to 5 inches, and



YOU CAN DO BETTER WITH



#### TOGGLE CLAMP ADAPTABILITY



There's always the right DE-STA-CO clamp for the job—no matter what the size or shape of the workpiece you have to hold. Choose from 13 standard styles, over 140 models or have DE-STA-CO engineers adapt one for you. Push, pull or lock with forces from 50 to 12,000 pounds! Quarter-, half-, and full-scale Templates available.





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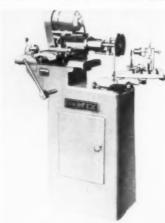
#### TOOLS of today

speed of testing up to 600 tests per hour. Tolerance is read from an illuminated glass plate. Adjustable stops permit testing of loads at 1, 2 or 3 different lengths in the same setup.

The Carlson Co., 3457 Weidner Ave., Oceanside, L. I., N. Y. Circle 415

#### Profile Cutter

Designed for sharpening cutting tools having radii in the cutting surface and for grinding clearances on profile type, straight or angular cutters, this No. 3 unit is comprised of a reciprocating horizontal wheelhead and a revolving workhead. It can accommodate arbor



type cutters up to 10 inches in diameter and taper shank mills up to 12 inches in over-all length. The machine will grind cutting clearances on end mills with right or left-handed spiral. single or multiple flute, straight or taper shank, of high-speed steel or cemented carbide and with plain radius or ball nose. It will machine straight or spiral. shank or arbor type milling cutters of cemented carbide or high-speed steel. of inserted tooth or solid, plain, face. side, angle or profile types. The motordriven, tangent arc grinder will accommodate wheels of 4 to 6-inch diam with face of 1/8 to 3/4 inch and bore of 1/2

Hartex Div., Union Twist Drill Co., Athol, Mass. Circle 416

#### Cleaning Compound

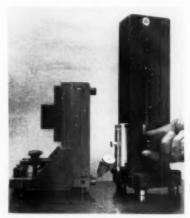
Thermoplastic material can be removed from extrusion and injection machines with a compound that provides clean moldings and eliminates rejects caused by contamination. Scrubbing action of the compound is provided by the low-melt index which

enables it to remain in a semistiff state in the molten stage, removing most stiff polymers and foreign matter such as carbon smears and color streaks. The hopper-fed compound, used in amounts which vary according to the size of the cylinder and degree of contamination, extrudes from the nozzle in a clean strand which can be directed to a scrap barrel. Preplasticizer units do not have to be separated from the shooting cylinders for cleaning. The compound can be readily flushed from the system with normal injection molding compounds.

Petrochemical Div., Allied Chemical, 61 Broadway, New York 6, N. Y. Circle 417

#### Machine Parts Tester

Squareness and straightness of machine parts and tools can be checked quickly, as close as ±0.0001 in 8 inches, with this inspection instrument. It can be used on a surface plate, machine table or in the part alone; can be used with a 0.0001, 0.0005 or 0.001-inch graduated indicator; and can indicate squareness and straightness in cavities, slots, recesses and other areas that are



difficult to reach. Vertical travel of the indicating head is eight inches. The master bar is adjustable in two directions to 0.025 inch. The traveling indicator head is antifriction, ball preloaded and requires no lubrication.

The Indi-Square Co., 1119 E. Ridge Rd., Rochester 21, N. Y. Circle 418

#### Welding Head

Compact enough to be installed in a standard dry box in which transistors and other electronic components are assembled, a precision welding head makes possible the use of lower welding currents and lower electrode pressures. The air chamber of the "M" head combines low inertia with fast action and protects the work with a cushion feature. Double action cylin-

ders provide high production rates. The head can be mounted horizontally or vertically, is adaptable to dial or in-line feed, can be used with either a-c or d-c power supplies, and is rated at 2700 watt-sec (d-c) or 50 kva (a-c).

Production Equipment Operations, Commercial Apparatus & Systems Div., Raytheon Co., 87 S. Bedford St., Manchester, N. H. Circle 419

#### Grinding, Indexing Machine

Space and time saving are made possible with this metal grinding and indexing unit. A rotary grinding table fits on a surface grinder to convert the unit to a rotary and/or OD grinder. A permanent magnet chuck on the surface



reduces clamping requirements. Illustrated is a flat workpiece mounted for rotary grinding. The sine plate can be opened to a vertical position, permitting grinding of the groove and OD of the workpiece. The 11-inch diam table can be used for indexing in milling and drilling operations by cutting out the motor and using positive location on gear keys.

Eight Mile Industries, Inc., 21290 W. Eight Mile Rd., Detroit 4, Mich. Circle 420

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#### Long Bed Lathe

Center distances to 132 in. (158 in. on special order) and either 16 or 18-in. swing are inherent in a geared head, long bed engine lathe. Twelve spindle speeds of from 20 to 900 rpm are obtained through two speed handles.

The gearbox has 48 separate threads and feeds and 3 to 184 threads per in. are available.

Standard bed can be furnished with inserted, ground and hardened V ways which are replaceable and are 64-66 R<sub>C</sub>, giving long life.

Carroll-Jamieson Machine Tool Co., Batavia, Ohio. Circle 421

#### Power Press Feed

Grippers adjust automatically and instantly to varied stock thicknesses, with pressure increasing or decreasing continuously in direct proportion to the load, while this power press feed is in



operation. The gripping rolls also adjust laterally to nullify the effects of stock edge curvature. Improvements in the model include a new brake drag and a stock guide which acts only on the edges, ½ inch in on each edge, permitting polished metal to be fed to the die without marring the finish. Maximum capacity of the air-operated feed is 36 inches.

Nadel Tool & Mfg. Co., Inc., 20 Warren St., New York 7, N. Y. Circle 422

#### Flow Control Valves

Three thousand-psi, pressure compensated, flow control hydraulic valves are for use as ordinary meter-in, meterout or bleed-off types. Use of the valves in a circuit allows excess oil to spill over a relief valve, permitting the pump to operate continuously at full horse-power. The knife edge orifice of the



series 8600 valves assures consistently uniform low flow, and minimizes change of flow when change of fluid temperature occurs. Pressure-balanced Teflon seals eliminate drain connections. Maximum flow capacities are up to 125 gpm in 1½-inch valves. Usable as two and three-port valves, units of the series are available in four basic sizes.

Rivett, Inc., Brighton 35, Mass. Circle 423

# IT'S A FACT

YOU CAN DO BETTER WITH



#### SPACING PRODUCTS

BECAUSE THE EXTRA PRECISION in materials, dies, manufacturing and finishing pays off when you specify DE-STA-CO products.

#### ARBOR SPACERS, SHIMS, SHOULDER-SCREW SPACERS



Arbor Spacers, complete range of sizes and thick-nesses from .001" to .125" with key. Shims same less key way. Same high quality in Shoulder-Screw Spacers. Spacing Collars in popular diameters, thicknesses from 1/4" to 3".

#### FEELER STOCK IN BOTH COILS AND STRIPS

Made from tempered stock and rolled to close limits. ½" x 12" or ½" x 25' finished lengths in thicknesses from .001" to .032". Especially helpful in precision fitting checking clearances and close tolerance work.



#### ACCURATE SHIM STOCK



Selected steel or brass, materials rolled to close limits—oiled, clean and flawless. Rolls 6" x 120" in thicknesses .001" to .032". 6" x 12" sheets packaged in 1 or 12 assorted gauges.



#### **TOOLS** of today

#### Indexing Tables

Slow start and stop motion on each index is provided in this mechanically locking and indexing table. Electric, air or hydraulic power is optional. The

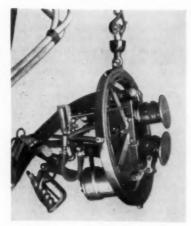


cam is rotated by a 40:1-ratio wormgear drive, giving a positive accurate lock on 180 deg of the rotation and a smooth turning motion on the other 180 deg. The indexing pawl is activated by a crank drive from the cam. Indexing can be up to 5000 per hour with relatively heavy fixture loads. The table is available with a 10 or 18-inch top and choice of station requirements.

Jackson Fluid Power Co., 16722 E. Warren Ave., Detroit 24, Mich. Circle 424

#### Portable Welder

Clamping pressures up to 1000 lb can be attained with this portable roll spot welder at production speeds of up to 250 ipm. Spot frequency is adjustable between ½ and 1½ inch automatic spacing. The unit will handle up to



three thicknesses of 0.032 sheet metal. The synchronized, double-wheel, air motor drive and contact rollers are available in various diameters to meet work requirements. Ring type mounting of the unit permits universal positioning, both horizontally and vertically.

Progressive Welder and Machine Co., 915 Oakland Ave., Pontiac, Mich. Circle 425

#### Universal Ironworker

Profiles and sections of many shapes can be cut with this Lansing machine available in four models from No. 0 up



to No. 2½. It operates at four different points for punching, shearing, cropping and notching operations. The unit performs as a punch, cuts angles and tees from 45 to 90 deg, and produces multishaped slots in angles, tees, channels, beams and plates.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y. Circle 426

#### Machine Mounts

Model UL mounts are designed for use under machines with leveling screws built into the feet or at load



#### He's Watching a Band Sawing Miracle

This band saw operator at the Bell & Gossett Company plant in Morton Grove, Illinois, is watching "Controlled Accuracy"... accuracy, being held to within a few thousands of being perfectly straight, and he can actually see the band blade being guided in the saw cut to produce this accuracy! No further machining is required before the pipe is welded into an assembly for a Bell & Gossett Heat Exchanger Unit.

Band sawing accuracy like this is nothing short of miraculous—especially when it can be done on a high production basis, as Bell & Gossett is doing. And when the same tolerances can be held on cut-off pieces from 2" to 18" in diameter, this Marvel. #81 Band Saw Machine can be truly called a precision machine tool.

The secret of this amazing sawing accuracy is in the MARVEL "SURE-LINE" Automatic Accuracy Control—a simple and extremely effective

tinuously senses and automatically corrects any tendency of a band blade to drift to either side of a desired line of cut. The "SUBF-LINE" unit literally "steem" the blade to make a straight cut. This permits the use of heavier feed pressures and, when desirable, higher blade speeds, to do the work faster, without sacrifice of accuracy. Incorporated in the new MARVEL #81 Series High Speed Heavy Duty Hydraulic Band Saws, the "SUBE-LINE" permits full utilization of all the advantages of high speed steel band saw blades—while extending their usable blade life as much as 50%.

electro-mechanical servo-mechanism that con-

Before you buy any band saw machine, get complete details on MARVEL #81 Series Single Cut, or Automatic Shuttle Type Bar Feed Preduction Band Saws—the machines DESIGNED AND BUILT TO REDUCE SAWING COSTS. Write for catalog foldery.



ARMSTRONG-BLUM MANUFACTURING CO.

5700 West Bloomingdale Avenue Chicago 39, Illinois



bearing points. They combine vibration control pads with a cast steel base plate which has a recessed center to accept the external leveling screw. The mounts eliminate need for anchor bolts, lag screws, grouting and shim plates and retain machine portability. They are available in sizes from 45% to 105% inches square, with maximum loadings per unit up to 7500 lb.

Unisorb, 210 South St., Boston 11, Mass. Circle 427

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Vacuum Furnace

Hardening, tempering, drawing and annealing refractory metals, stainless and special alloy steels can be done with this 200-lb capacity automatic high vacuum cold wall type furnace. Work space of the unit is 26 x 26 x 24 inches.



Operating temperature is 2600 F, maximum operating pressure is 0.1 micron Hg, and power supply required is 150 kw/hr.

Ipsen Industries, Inc., 721 S. Main St., Rockford, Ill. Circle 428

#### Optical Profile Grinder

Fully automatic longitudinal and cross feeds are now available for the Lowe optical profile grinder. In combination with the infinitely variable derives for wheel and stroke speeds, the upper and lower lighting systems, 25x



and 50x magnifications, and the 21 x 21-inch screen, the feeds provide increased versatility and better grinding surface. The unit permits feeds rates in small increments from 0.0004 to 0.006 inch per grinding slide stroke and an overall feed range from 0.014 to 0.425 ipm.

Eric R. Bachman Co., Inc., 27-11 41st Ave., Long Island City 1, N. Y. Circle 429

#### Powder Metal Sprayer

Lightweight and compact, this spray welding unit has a spray rate of more than 12 lb per hr and deposit efficiency up to 95 percent. Redesign of the pistol includes the combination of trigger and powder flow control in one positive acting operating valve. The unit is 20 percent lighter than the former model. The air-powered powder feed is opera-



tional in any position through 360 deg in vertical or horizontal planes and insures nonporous powder deposits. The unit consists of a spray pistol and panel-mounted hopper with carburetor plus air filter and regulator. Powder storing capacity is 15 lb—enough for 1 to  $1\frac{1}{2}$  hours of steady spraying of any metal in powder form,

Wall Colmonoy Corp., 19345 John R. St., Detroit 3, Mich. Circle 430

# ARMSTRONG

#### A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with adequate numbers of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for every standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs.



BROS. TOUL CO. 5257 W. ARMSTRONG AVE. CHICAGO 46.
Use Reader Service Card, CIRCLE 70

#### TOOLS of today

#### Barrel Finishing Media

Bonded shapes for abrasive tumbling include round and triangular pins (illustrated) for barrel finishing intricate parts. Round pins are available in \(^5\)\%: inch length in diameters of \(^6\)\%: inch length in diameters of \(^6\)\%:

The triangular pin is effective with length inch length inc



Dies cost less to build, less to buy
when you specify
RING Punches and Dies



Check your in-shop estimates. Then check Ring prices. Figure the extra savings in reduced die assembly time ... and you will see how you can economize with Ring, yet retain quality.

RING or SOLID HEAD type punches in stock...round, oblong, square, rectangular, slug ejector, pilot, blank. All punch points ground to specified decimal sizes at no extra charge. Ring or press fit type dies from stock with hole sizes to proper clearance for the material to be punched. SPECIALS in choice of steels, to your specifications.

WRITE Dept. E for New Catalog of headed and Ring punches and dies, ejector punches, shoulder and bevel quills, and stripper guide bushings.



RING PUNCH & DIE DIVISION

OF THE PRODUCTO MACHINE COMPANY



JAMESTOWN, NEW YORK

slotted parts, reaching the inside rightangle corners easily with the 60-deg edge angle presented to the work. The shapes will process ferrous and nonferrous metals, plastic and rubber parts.

Norton Co., Worcester 6, Mass. Circle 431

#### Adjustable Speed Drives

Designed to apply adjustable speed power to conveyors, fans and pumps, winders and metal slitting and forming machines, a line of a-c drives are of integral-unit construction, and rated from ½ to 100 hp. Larger drives with separate motor mounted on a bedplate are available up to 700 hp liquid cooled. Optional control modifications can provide a variety of speed operating functions. The drives can be set before or

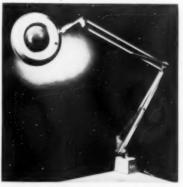


during operation and remain adjusted. A built-in tachometer monitors and automatically corrects the output speed, regardless of load change. The drive unit illustrated is available from three hp. 800 rpm to 100 hp. 1700 rpm.

Westinghouse Electrical Corp., P. O. Box 2099, Pittsburgh 30, Pa. Circle 432

#### Inspection Lamp

A 22-watt circlite lamp and a 5-inch magnifying lens, have been combined in this illuminating lamp designed for use at inspection stations and in assembly of small parts. Both units are contained in the swivel shade and light is

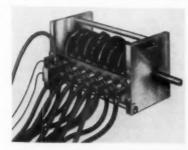


automatically directed onto the part being magnified. The head is moveable through 354 deg. Model M-1C is available for clamp, wall or pedestal mounting.

Swing-O-Lite Inc., 13 Moonachie Rd., Hackensack, N. J. Circle 433

#### Sequence Programmer

Precise control of automatic tooling and work operations can be had with this pneumatic-electrical programming unit. End plates are tapped for bottom or rear mounting. The shaft can be extended out either or both ends for tandem operations. A choice of eight



easily altered standard cams meet varied requirements. Special cams with degree of rotation cuts other than standard are available. The unit can be driven by any power source supplying a minimum torque of 10 in-lb.

Clippard Instrument Laboratory, Inc., 7390-P Colerain Rd., Cincinnati 39, Ohio. Circle 434

#### Mild Carbon Steels

GLX-W steels are high strength, fine grained, semikilled mild carbon steels treated with varying amounts of columbium. The chemical treatment increases tensile properties and lowers temperature toughness without affecting ductility. The steels are comparable to those mild carbon steels in the 30,000 to 40,000 psi range, but the minimum yield strengths of GLX-W steels is higher by 15,000 to 20,000 psi. The steels are easily weldable and have excellent forming qualities. They are available at four levels of minimum yield strength: 45,000; 50,000, 55,000 and 60,000 psi. They are suitable for large-diameter pipe.

National Steel Corp., Grant Bldg., Pittsburgh 19, Pa. Circle 435

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Miniature Cutting Tools

Twist drills, pivot drills, center drills, reamers and end mills are included in a line of miniature, high-speed, steel cutting tools. Twist drills are available in sizes of 0.15 through 0.50 mm, in both right and left-hand cut. Pivot drill sizes range from 0.10 through 0.40 mm, with 1.00-mm diam shanks. Size 00 center drills have a 0.025-inch drill



diameter and %4-inch body diameter, and size 0 have a ½2-inch drill diameter and a ½-inch body diameter. Radial design produces centers that do not require deburring. Straight-shank, straight-fluted reamers are available in wire gage sizes 61 through 80 and in fractional sizes of ¼4 and ½2 inch. Tolerance is + 0.0002, - 0.0000 inch. Miniature end mills come in 11 different styles and size ranges of from ½2 through ¾6 inch by 64ths. The single, double and ball-end styles all have ¾6-inch shanks.

The DoAll Co., Des Plaines, Ill. Circle 436



FERRO-TIC (the only machinable carbide in existence) combines the fabricating advantages of steel with the wear-resistance of carbide. In the annealed, completely dense state, FERRO-TIC can be machined with high-speed tools on conventional tool room equipment; thus, the need for costly diamond grinding is eliminated. Once hardened, by oil quenching from 1750°F, FERRO-TIC stock blanks can be fabricated into long-wearing components, using available tools and skills without delay! FERRO-TIC is ideal for: Blanking, Lamination, Deep Drawing and Heading Dies, Arbors, Core Rods, Wear Parts, etc. FERRO-TIC can be turned, drilled, milled, sawed, tapped....



AGENTS THROUGHOUT THE U.S.A. WRITE FOR ILLUSTRATED BULLETIN T-5

Division of CHROMALLOY CORPORATION

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\*Reg. U. S. Trade Mark \*\*AVON Tube Div. HIGBIE Mfg. Co.

develop your angles and repeat them!

# ALINA SELECT-O-POINT drill grinders



Designed for rapid and accurate grinding of:
Twist Drills • Sub Land Drills • Step Drills
• Spot Facing Cutters • Keyway Milling
Cutters • End Mills • Reamers • Screw Taps
• Engraving Needles, etc.

Three models to choose from — No. 01-2 Range .004" thru .080"—No. 03-6 Range .012" thru .250"—No. 2-32 Range .080" thru 1.250". Each machine is a complete system built around a planned drill point. Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated exactly at any time. Accuracy and simplicity is built into each machine.





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#### ALINA CORPORATION

122 East Second Street, Mineola, Long Island, New York Alina Corporation, 853 East 8 Mile Road, Detroit 20. Michigan Jerico Inc., 4744 West Lake Street, Chicago 44, Ill.

Harry M. Smith & Assoc., 1341 Old County Rd., Belmont, Calif. W. F. Wolf Machinery Co., 2910 Santa Fe Ave., Los Angeles 58, Calif. Lemuel R. Lance, Inc., Fifth & Courtland Sts., Phila. 40, Pa. Use Reader Service Card, CIRCLE 73

#### TOOLS of today

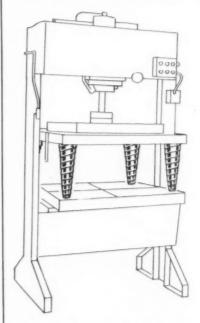
#### Electric Furnace Accessories

Six functional accessory groups make it possible for the Type 2100 electric furnace to perform several distinct operations when used as a salt bath, oil bath, melting, vertical muffle or crucible furnace. The accessories are two alloy stainless steel post with covers for liquid heating to 1000 and 1600 F; a safety lifting handle for the pots; a perforated stainless steel skimmer for removing sludge or crust; a graphite melting ladle for use to 1700 F; and a high-temperature refractory chamber liner and chamber cover.

Thermo Electric Mfg. Co., 465 Huff St., Dubuque, Ia. Circle 437

#### Guide Pin Cover

Pins and bushings can be protected from nicks and scratches by a onepiece guide pin cover made of tool steel and available in a wide range of sizes and lengths. The cone-shaped cover is helically wound to snap into place over



pins and bushings. In addition to protection of pins from feeding raw materials, the covers provide seal-in lubrication and prolong die life. They also close the pinch-point on a die set, protecting workers against injury.

Elasticone Div., Central Safety Equipment Co., 6601 Marsden St., Philadelphia 35, Pa. Circle 438

# New

## TWIST DRILL GRINDER

Model KBS-3



Model KBS-3 sharpens new and used right and left hand drills and cutters, from 0.008" to 0.120" dia. with microscopic accuracy. Models for larger drills also available. Point angle adjustable from 90-180°; Relieving 0-20°; Concentricity guaranteed.

Standard Equipment: 20X magnifying glass, dressing diamond, adjustable side-stop for flat drill grinding, grinding wheel, lamp.

Simple to operate, ANYONE can grind precisely with the Meteor after 10 minutes instruction.

For further information,

and free-trial offer, contact...

# ASSOCIATED AMERICAN WINDING MACHINERY, INC.

750 St. Ann's Avenue, New York 56, N. Y. CYpress 2-5050 5935 West Grand Avenue, Chicago 39, III. TUxedo 9-0700

Use Reader Service Card, CIRCLE 74

May 1960

#### Shaped-Hole Punch

Designed to punch both round and shaped holes, the standard line of CJ units include holders and die bases keyed to take shapes, is quickly con-

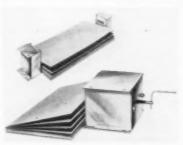


vertible, and will punch holes up to 0.875-inch diam in ½-inch thick material. Other units in the line punch holes up to 3½-inch diam in ½-inch material, but do not have the die base.

Wales Strippit Inc., Akron, N. Y. Circle 439

#### Magnetic Separator

Stacked sheets of steel, ranging in thickness from 32 gage to 7 gage, can be separated and floated by this adjustable magnetic unit. Designed to facilitate the feeding of round, square or irregularly shaped sheets into presses, shears and other production



equipment, the separator reduces possibility of equipment damage due to multiple sheet feeding and lowers production time. A hand crank provides accurate setting. The units can be used individually or in groups of two or more to accommodate any required stack height or width.

In addition to the adjustable unit, 18 standard models are available for specific pages.

Magnetool Div., Multifinish Mfg. Co., Detroit 40, Mich. Circle 440

Use Reader Service Card, CIRCLE 75





American Twist Drills are not readily available—The American Automotive Industry demands practically all capacity for precise, uniform mass production requirements. Eventually they will be available to all industry through selected Industrial Distributors.



American Twist Drill Co.
Detroit, Michigan
Subsidiary of:
Cutting Tool Division
Brown & Sharpe Mfg. Co.,
Providence 1, Rhode Island



#### TOOLS of today

#### Frameless Rolling Mill

Aluminum and steel strip can be cold rolled with this nine-stand, self contained rolling mill. All rolls are mounted in bearing blocks that are pulled together by hydraulic cylinders. Dual synchronized screws are used to push the rolls apart for regulating the gage of material to be rolled. The design eliminates the need for roll frames and makes it possible to build a tan-



dem mill with all rolls set on very close centers, reducing overall dimensions and simplifying power transmission. Rolls can be raised hydraulically for threading or clearing and hydraulically returned to original gage settings.

Production Engineering Co., 1795 Massachusetts Ave., Riverside, Calif. Circle 441

#### Short-Run Tool Kit

One bar and two adjustable cutters make up a kit for limited boring and reaming operations. Without disturbing the bar setup, a cutter ground for boring can be replaced by a second cutter which is ground for reaming. Since the cutters are fully adjustable, a wide range of diameters can be machined with minimum tool inventory and short setup time. The standard slot bar and cutters are operable with holes 5% to 1 inch in diam. A heavyduty bar and cutters will bore and ream holes of 1-inch diam or more.

Muskegon Tool Industries, Inc., Muskegon, Mich. Circle 442

#### Fast Carbide Planer

Maximum performance and low cost are combined in 30, 36 and 42-inch basic size models of this small fast carbide planer. Available in nine combinations of table widths and heights, the machine's components resist torsional deflection and vibration under the heaviest of cuts in either direction.

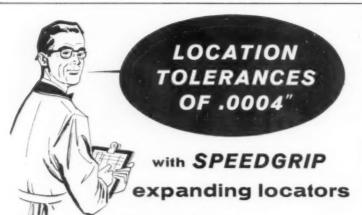


Column face, rail and rail heads are square locked, providing rigid resistance to forward and reverse cuts produced in double cutting. The variable voltage drive is 60 to 75 hp and the constant torque motor is adjustable from 180 to 1800 rpm. The 6:1 planer ratio provides table speeds of from 30 to 300 fpm. Single or double cutting heads, or any combination of both, are available.

The G. A. Gray Co., Cincinnati 7, Ohio, Circle 443

#### Turret Indexing Unit

Intermittent motion for high volume assembly and processing operations is provided with this miniature turret indexing unit. The Series J is built for semiautomatic bench operations or for



Gain accuracy—Save time— Avoid errors in loading or unloading work from fixtures! Speedgrip expanding locators are guaranteed to repeat fixture location within .0004". Nationally known customers find Speedgrip locators indispensable for holding required tolerances! Assures easier loading and unloading of work.

No. 0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from 1/2" to 3/4" dia.



No. 2 Locator with hand knob actuation. With expansible bushings, this locator can be used for bores from 1" to 2" dia.



This No. 5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expansible bushings, this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from 3/8" to 11".

Some Open Territory . Dealer Inquiries Invited

#### FREE!

Write for Bulletin No. 27 for full description and technical details.

#### SPEEDGRIP CHUCK

Division of ERNEST, HOLDEMAN & COLLET, INC.
Elkhart, Indiana



use as a small automatic machine

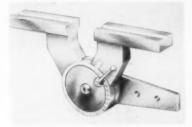
The unit has a 12-inch diam turret, eight work stations and an index to dwell relationship of 1:1 (180-deg index). A hardened steel crossover indexing cam provides cycloidal displacement. Foot or flange type mounting is ontional.

Swanson-Erie Corp., 816 E. Eighth Ave., Erie, Pa. Circle 444

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#### Work Holders, Clamps

Where cost of permanent jigs is prohibitive, a line of work holders and clamps can be used in short-run welding, soldering and brazing for the positioning of pipes, rods, tubes plate bars and other structurals.



Adjustable, angle and straight type holders can be used singly or combined for two or three-way joints, providing jig-type setups. The adjustable type (illustrated) can be set at any angle from zero to 180 deg.

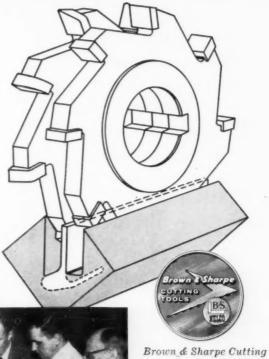
Wales-Strippitt, Inc., Akron, N. Y. Circle 445

#### Cutoff Wheels

High-speed production cutting can be done with a line of Dayton safety resinoid, resin-rubber and rubber, reinforced and nonreinforced straight cutoff wheels in thicknesses from ½2 to ¼ inch. Resinoid, resin-rubber and all reinforced wheels are available in diameters up to 20 inches. Rubber wheels are available up to 26 inches in diameter. The wheels are fabricated from aluminum oxide and silicon carbide

## Changing to NELCO Carbide Tipped Cutters gives Hinge Manufacturer Tremendous Competitive Advantage!

Drawing shows one milling operation that eliminated 5 others and completed cuts 6 times faster than cutters previously used.



Brown & Sharpe Cuttin Tool Engineer demonstrates faster milling speeds and improved surface finish on aircraft hinge using Nelco Cutters in gang.

A Brown & Sharpe Cutting Tool Engineer, with the approval of management in a plant making aircraft hinges, assisted in effecting substantial production savings and improved quality on dozens of production milling projects.

Nelco Carbide Tipped Cutters now mill a 72" bronze hinge piece, in one pass, at 12 to 15 inches per minute feed and produce a superior finish. Formerly, a feed of 1 inch per minute was maximum. Time for another milling operation was reduced from one hour to 2½ minutes.

Tremendous production benefits can result from B&S Tooling Service.

A B&S Cutting Tool Engineer in your shop can show you how... and he will, if requested, hold a training course for machine operators in your shop.

There's no obligation. It's all part of the new B&S COMPLETE TOOL-ING SERVICE. Call your local B&S Distributor today.

Send for the B&S-NELCO "Condensalog."

For that **EXTRA** Edge in Production

NELCO

NELCO Tool Co., Inc.

Subsidiary of: Cutting Tool Division Brown & Sharpe Mfg. Co., Providence 1, Rhode Island

#### **TOOLS** of today

abrasives in various combinations and grain sizes required by application.

Simonds-Worden-White Co., 1101 Negley Place, Dayton 7, Ohio. Circle

#### Parts Feeder

Model FE-103 parts feeder is capable of handling up to 200 parts per minute. It has a motor-driven drum, variable speed control, can be installed in either dial-index or in-line transfer applications, and can be arranged to operate with screwdrivers, positioners and other assembly equipment. The feeder can be equipped with solenoid-operated, ram type or other escapement. A variety of orienting devices are avail-



able. The unit will accommodate piece parts up to 11/2-inch diam or of lengths up to 3 inches. Bowl capacity is 700 cu inches and drum diam is 16 inches.

Dixon Automatic Tool, Inc., 2300 23rd Ave., Rockford, Ill. Circle 447

Moore No 3 lig Grinde

model, you can grind-with aplit-tenth accuracy-holes

strokes are provided for chop-grinding ... infinite spindle speeds, 40 to 250

#### Natural Diamond Grit

In contrast to conventional abrasive, natural diamond grit contains a high volume of needle-like particles which greatly increase grinding efficiency of resin-bonded wheels in certain applications. The needles are held more firmly in the wheel and are more friable than cubic and rectangular shapes.

Industrial Diamond Div., Engelhard Industries, Inc., 113 Astor St., Newark 2. N. J. Circle 448

#### Ring Assembly Machine

duction assembly of radially installed cresent rings, E-rings and reinforced E-rings, the Truarc Ring-O-Mat assembly machine provides rapid loading with stacked rings supplied in cartridges. The unit illustrated installs two rings simultaneously in the roller assembly in front of the operator. A reinforced E-ring is used to secure the large roller to the base plate. A smaller E-ring fastens the roller at the right.



A single assembly station can be equipped to install any number or combination of ring types and sizes in one operation. Limitations are determined only by the accessibility of ring grooves in the workpiece.

Waldes-Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y. Circle

Designed for high-speed, mass-pro-



## Throwaway Carbide

Developed for high-speed and highprecision machining and for finish machining hard alloys, grade K165 is available in throwaway inserts for all types of Kendex tooling. The steel cutting grade has a titanium carbide base and high edge-wear and crater resistance that combine to reduce loss of size in machining and finishing cuts. The material provides surface finishes of 12 rms, eliminates grinding in many operations, and eliminates the need of special tooling and laboratory controls in finish machining many alloys.

Kennametal Inc., Latrobe, Pa. Circle

#### "The No. 3's split the tenths!"

So report users of Moore's New Jig Borer and Jig G



our Moore Jig Boring and Jig Grinding Department to 15 ma ), and Karl Harig, Chairman (at right), Harig Manuta



u will easily break the "tenth" barrier with this ac-curate machine. No gibs...no ing surface. It bores, drills, reams and spots holes in dies, jigs and production

All hardened, ground and lapped ways. Made and calibrated national is

Write today for literature describing the many advantages of the No. 3 Moore Jig Borers and Jig Grinders.

MOORE SPECIAL TOOL COMPANY, INC.



ts Corporation, Providence, Rhode Island, is this tal tra-precise results with the No. 3 Moore Lia Grinder



without Moore equipment. This cost factor is just one of many teasons why we recently added the new Moore Model No. 3 Iig Grinder. This Machine, with its tenth-splitting accuracy, hard-Statement by Val Koller, President, Koller Die & Tool Co., Milnaukee, Wiscons



DLES, CONTOURS AND SURFACES.

ADD (TALLS) TO YOUR TOOLROOM

#### Precision Machine Chuck

Operable by either a lever type collet closer or by an air cylinder, and quickly interchangeable with collets, this chuck can be used for ID or OD holding and will work up to  $3\frac{1}{2}$ -inches diam. Blank



top jaws can be bored out to fit the workpiece. The unit is accurate to 0.0005 inch. An optional actuator provides controlled and uniform holding pressure, regardless of variations in the workpiece diameter.

PowerGrip, Inc., Rockfall, Conn. Circle 451

# Maximum Diameter — 5% inch. For fast-production, multi-spindle machines. Specially heat-treated, high speed steel. With back taper or radial relief. Made by specialists in the design of small tools.

WOODRUFF & STOKES CO.

INCORPORATED

BIdg. 32, 357 Lincoln St., Hingham, Massachusetts

Use Reader Service Card, CIRCLE 79

May 1960

#### Mounting Fixture

Multiple installation of up to six guide line lights can be done with a mounting fixture that permits easy adjustment of shadow lines for various operations. The



baffle plate arrangement in each light prevents the projected patterns from overlapping or interfering with patterns of adjacent lights.

Carter Products Co., Inc., Grand Rapids 2, Mich. Circle 452

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#### **Electric Vibrator**

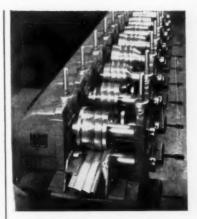
Stubborn materials can be moved through bins, chutes and hoppers with this explosion-proof electric vibrator. The RC-32 unit can be used in atmospheres containing natural gas, gasoline, naptha and similar vapors. Operation is quiet and maintenance minimal because the vibrator uses no pulleys, belts



or springs. It delivers 3600 vibrations per minute with 60 cycle current. Vibration force is produced by eccentric weights fastened on each end of the motor shaft. Impact is adjustable from 385 to 1100 lb with seven separate settings. The vibrator is available in three-phase, a-c current at 220 or 440 volts. Input is 500 watts.

The Wellman Co., 1405 E. 6th at Rockwell, Cleveland 14, Ohio. Circle

(Continued on page 179)



#### Yoder Roll-Forming Equipment mass-produces shapes accurately, economically

Yoder Roll-Forming Equipment, even with part-time operation, can effect significant savings in many metal working applications and industries. Shapes, simple or complex, can be quickly and economically produced the Yoder way from a wide variety of flat-rolled coated or uncoated stock ... in thickness up to 34 inch... in speeds up to 50,000 feet per day.

Yoder engineers flexibility and precision into metal forming operations. For example: many basic shape modifications, such as coiling, welding, notching, ring-forming, perforating, and cutting to length can be simultaneously accomplished with little or no additional labor cost.

Yoder also makes a complete line of Rotary Slitters and Pipe and Tube Mills. Profit from Yoder's years of engineering and service experience, contact your local Yoder representative or send for the Yoder Roll-Forming Manual.

This fully-illustrated 88page book clearly discusses every important aspect of Yoder Roll-Forming Equipment and methods...it's yours for the asking!



#### THE YODER COMPANY 5525 Walworth Avenue • Cleveland 1, Ohio





COLD ROLL FORMING MACHINES



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2	21	40	59	78	97	116	135	154	173	414	433	452	471	308	327	346	365	719
3	22	41	60	79	98	117	136	155	174	415	434	453	472	309	328	347	366	720
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6	25	44	63	82	101	120	139	158	177	418	437	456	475	312	331	350	369	
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8	27	46	65	84	103	122	141	160	401	420	439	458	477	314	333	352	371	
9	28	47	66	85	104	123	142	161	402	421	440	459	478	315	334	353	372	
10	29	48	67	86	105	124	143	162	403	422	441	460	479	316	335	354	373	
11	30	49	68	87	106	125	144	163	404	423	442	461	480	317	336	355	374	
12	31	50	69	88	107	126	145	164	405	424	443	462	481	318	337	356	375	
13	32	51	70	89	108	127	146	165	406	425	444	463		319	338	357	376	
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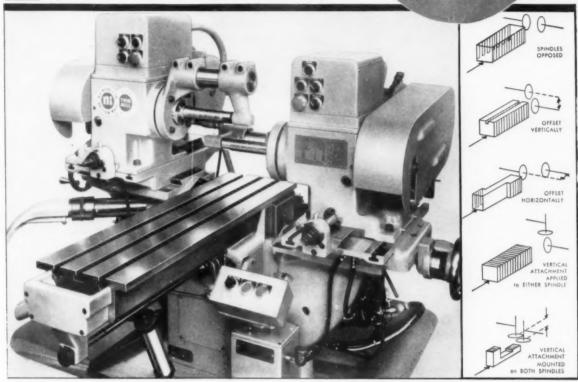


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# MORE POWER MORE RANGE

NICHOLS TWIN MILL

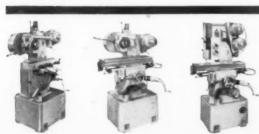
PLUS Unequalled Versatility and Accuracy



Now, the versatile Nichols Twin Mill is available with wider, heavier 36" table for greater work capacity, and 2 HP motor drive to each milling head for greater cutting capacity. Along with increased range and power the Twin Mill is equipped with a fail-safe electrical system which automatically returns all the power feeds to their starting positions in the event of a power failure

#### Twin Mill features that have built its reputation:

- Unique six-way adjustability of each milling head for fast set-up
- Automatic cutter retraction on table return stroke
- Double table cycling allows rough and finish cuts at one set-up
- Push-button controlled automatic air-hydraulic variable table feed cycle
- · Automatic lubrication of table ways
- Fifteen speeds from 50 to 2050 RPM suitable for all materials
- · Vertical Heads for either or both horizontal spindles





Write for details on the complete Nichols line,
"The Millers that Use Their Heads"

Sound, color, 16mm. movie "The Millers that Use Their Heads" available on free loan basis.

MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors REM SALES INC.
subsidiary of The Robert E. Morris Company

5006 FARMINGTON AVENUE . WEST HARTFORD 7, CONN.



# The 1960 SUPPLIERS DIRECTORY ISSUE of THE TOOL ENGINEER

Your "National Directory of Local Sources!"

Your time is mighty valuable. When you need a product vital to your work, you usually need it—now! You don't want to burn up precious hours seeking out the product source.

An exceptional time-saver in this respect is THE TOOL ENGINEER Suppliers Directory Issue—the expanded, improved 1960 version of which will be in your hands the week of June 15. This issue will give you everything you need in way of product information—including an exclusive means of finding local sources of products in minutes rather than in hours or days.

The Suppliers Directory Issue is "easy as A-B-C" to use. It contains three major, color-coded groups of listings, arranged alphabetically, cross-referenced and indexed for your convenience, as follows:

PRODUCTS SECTION (on blue pages)—listing 1,200 products important to tool and manufacturing engineers. Found under each heading are the names of manufacturers of that product.

- 2 MANUFACTURERS SECTION (on yellow pages)—presenting the names and home office addresses of 3,000 manufacturers. State and numerical designations which appear after the manufacturers' names identify their local sales outlets across the country.
- 3 SALES OFFICES SECTION (on pink pages)—giving you the names, addresses and telephone numbers of more than 20,000 local sources of needed products. This exclusive feature makes the Suppliers Directory Issue of greatest value to the user, the most useful reference of its kind in the industry.

In addition to this vital information, the Suppliers Directory Issue will contain helpful technical articles prepared by the editors of THE TOOL ENGINEER.

The Suppliers Directory Issue is published as the thirteenth issue of THE TOOL ENGINEER. It is included as a regular issue in the basic subscription price to ASTME members and non-members. Watch for it! Make good use of it!



Publication date: June 15, 1960

THE AMERICAN SOCIETY OF TOOL AND MANUFACTURING ENGINEERS

#### **TOOLS** of today

#### Photoelectric Microscope

Simplicity and fatigue-free sensitivity are combined in this microptic microscope. The photoelectric detector, added to the visual-setting eyepiece, registers a null reading on the meter when the scale graduation is absolutely central in the field of the calibrated slit.



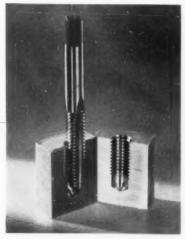
The unit provides a total measuring range of 0.05 inch. The instrument can be provided with a light source to illuminate the scale and can then be used to read graduations from 0.0001 to 0.0015 inch in width on any precision scale.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill. Circle 454

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#### Chipless Tap

Cold forming fluted taps, with low drag and driving torque, form threads without chips. Fluting of the taps allows lubricant to move directly to the



forming area, increasing tap life, providing smoother threads, and allowing the same tapping equipment used for standard taps of equivalent size to be employed. The flutes do no cutting.

Jarvis Corp. Tap Subsidiary, North Attleboro, Mass. Circle 455



Your Ready Reference for

... PRODUCTS

.. MANUFACTURERS

... SALES OFFICES

for Production Planning

Completely new, this up-to-date guide of manufacturers and suppliers of products should be at the finger tips of every tool and manufacturing engineer. Designed and tailored for ready reference, this directory quickly identifies the manufacturers of 1400 products specified by tool and manufacturing engineers.

It not only lists the sources of supply for these products but also includes addresses and telephone numbers. This novel arrangement makes product information as near to you as your telephone. More than 3,000 manufacturers have listed some 20,000 sales outlets.

The Tool Engineer

on the line. very few production line on thousandths.of-an-inch incorporate many Acme output! America's missiles, depend gh to toe suc But Acme I has produced scores and small, that meet about made parts. To lay exacting re accuracy, dustrial we're verv.

does it seals on nut assemblies-to list a assemblies . housing division

#### ACME INDUSTRIAL COMPANY

SEND... FREE facilities book to your new-off-the-presses me. I'd like to see what your equipment is, what you've done, how it can help our operation.

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#### **TOOLS** of today

production ability

hese

capabilities

experience...the proved

reputation

fow

variety of machines . . the more-than-a-decad

have the number and

#### Cross-Slide Rotary Table

Setup time for machining dies, cams, templates, rubber and plastic molds, tools, gages, models and fixtures, and for boring and grinding jobs, can be reduced with this cross-slide rotary



table, with which it is seldom necessary to move or reclamp the workpiece until all cuts are complete. The cross-slide is quickly adjustable to position work for cutting any radius whose center point lies within a nine-inch square area centered on the table.

Morrison Machinery and Engineering Corp., 935 W. Lake St., Chicago 7, Ill. Circle 456

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#### Profile Grinder

Cutting clearances on cutters, mills, counterbores and reamers, and special multidiameter and interlocking type cutter gangs can be ground with this



No. 5 machine. Comprised of a reciprocating horizontal wheelhead and revolving workhead, the grinder can accommodate arbor type cutters up to 30 inches in diameter and taper shank mills up to 18 inches in over-all length.

Hartex Div., Union Twist Drill Co., Athol, Mass. Circle 457

(Continued on page 182)



the special meaning

#### of BAIRD

It didn't take us long to learn that one of the secrets of success in the production end of the automatic mathe automatic machinery building business was simply following our own advice.
Since 1846, sales representatives of the Baird Machine Company



**Vertical Continuous** 

tives of the Baird Wertical Continuous Machine Company Lathe have been calling on their customers and prospects preaching the gospel of cost reduction, quality control and improvement through modern, up-to-date machinery. The impossibility of achieving precision, accuracy and constant, trouble-free output of production parts on obsolescent economics. production parts on obsolescent equipment

became quite apparent.
With us, here at Baird, it became

Four-Slide

"preaching" which we ourselves "practiced". Most machines we have in our shop represent what we con-sider to be the best equipment for the job. New machin-ery acquisitions and improvements undergo constant

evaluation. Result, manufacturing standards for which Baird is famous.

Machines, of course, are only part of the story. Our "people" facilities list is equally impressive. Grandsons of men who worked on Baird Chuckers, Transfer Presses, Four-Slides, Barrel Finishing equipment and Bench Presses work with us now, taking a family price in the machines the second family pride in the machines their company produces. There is an atmosphere of Yankee craftsmanship in our plant that combines with 114 years of experience and an anxious anticipation of the future to make its mark on our people.

Another example of the special meaning

FRED OLSEN

#### THE BAIRD MACHINE COMPANY

1200 Stratford Avenue, Stratford, Conn. Use Reader Service Card, CIRCLE 86

Use Reader Service Card, CIRCLE 87

Another addition to the famous "Greenfield" Line . . .

### Greenfield

Tru-Lede

# Fluteless Taps

Patent No. RE. 2457

100

FOR

PRESSURE FORMING
INTERNAL THREADS

IN

COPPER

BRASS

ALUMINUM

DIE CASTINGS

LEADED STEELS

and other ductile materials

A Greenfield field engineer is available to talk over your tapping requirements and to discuss how TRU-LEDE TAPS can help you. CALL HIM THROUGH YOUR GREENFIELD DISTRIBUTOR. TRU-LEDE fluteless taps do not cut
threads in the same manner
as conventional taps. Actually
they are a forming tool
and their action may be compared
with external thread rolling.
No problem of chip disposal as
there are no chips with this method.
Under proper conditions
and in the appropriate materials,
they are giving outstanding
results in hundreds of applications.

Ask your GREENFIELD Distributor for a copy of this 4-page pamphlet. It contains the complete story: Sizes available, recommended limits, selecting the right tap drill, and other information you'll want to have.



GREENFIELD TAP & DIE

GREENFIELD, MASSACHUSETTS

#### DYNAMIC POLISHING AND DEBURRING

The GRIND-O-FLEX saves valuable production time in polishing and deburring rounded, contoured and flat surfaces. A flexible abrasive wheel that features SLASHED construction, type BL GRIND-O-FLEX practically envelopes the part with dynamic, moving abrasive.

Easy to use, economical, the GRIND-O-FLEX consists of a rugged hub that holds a number of simple-to-replace abrasive pads. No special tools are required to load the hub.

The pads, available in a variety of grits, wear evenly, exposing a continuously fresh abrasive surface.

Write today!..for illustrated technical bulletin and price list.



First choice is always a product of Merit

3691 Lenawee Avenue, Los Angeles 16, California



Use Reader Service Card, CIRCLE 88

#### TOOLS of today

#### Full-View Disk Grinder

A special fiber-backed abrasive disk with two parallel straight sides, resulting in a rectangular section with a radius at each end, makes it possible to disk-grind with the workpoint in full



view of the operator. As the disk rotates, an inch at the outer edge-where the grinding is done-becomes transparent, eliminating the need to move the disk away from the work for inspection. Dwell time is reduced since grinding is confined to a specific area. Behr-Manning Co., Troy, N. Y. Circle

#### Midget Air Cylinders

Maximum power can be supplied in minimum space with a line of small, powerful air cylinders. The doubleacting units have one-inch bores and are suitable for air pressures up to 125





These important parts are coldformed from coiled wire, start to finish in compact, efficient National Cold Headers.

The top three are formed with no scrap loss, ready to use! All six achieve remarkable savings over past methods.

If you make odd-shaped parts, may we help you evaluate them for cold-forming from wire? Better yet, come to Tiffin, witness our demonstrations and let's discuss your work.



Use Reader Service Card, CIRCLE 89 The Tool Engineer psi. Stroke sizes of 1, 2, 3, 6, 9 and 12 inches are provided by six models in the series. The cylinders are suited to light-duty and gang type air applications such as operating jigs and fixtures or transfer and special purpose machines, and they can be neck, angle-leg or clevis-bolt mounted.

A. Schrader's Son Div., Scovill Mfg. Co., Inc., 470 Vanderbilt Ave., Brooklyn, N. Y. Circle 459

#### Threading Lathe

Model 3L automatic cycle threading lathe is an extra long machine with an 80-inch stroke and 84 inches between centers. It will thread internally or externally by a series of passes in which the spindle speeds, feeds and number of passes are preselected. Shutoff is

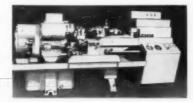


automatic at completion of the cycle. Available with the unit are spindle bores of up to 16 inches and swings of up to 24 inches. With additional attachments, tracing, facing, turning, cutoff, chamfering, shouldering, boring and threading are possible in a single chucking operation.

Man-Au-Cycle Corporation of America, Brooklyn 32, N. Y. Circle 460

#### Hydraulic Drive

Any ram turret lathe can be converted to a fully automatic production machine with this hydraulic drive unit for turning, facing, boring, deep-hole drilling, undercutting and forming. The unit can tap and chase both right and left-hand threads. It provides rapid traverse, feed dwell, reverse feed and rapid return for index. The drive opens and closes collet; selects and engages proper spindle speed for each station: and operates the cross slide which is independent of the ram. In drilling op-



erations, chips are removed by automatic reciprocation of the drill. A backfeed attachment allows a finish cut on the return stroke.

Lincoln Industries Co., 1121 S. 7th St., Minneapolis 4, Minn. Circle 461

#### Motor Control Centers

Available either as fusible or circuit breaker combination units, motor control centers with bus capacity from 200 to 2000 amps for voltages from 110 to 600 consist of two or more starters fed from a common bus. They can be attached to transformers or switchgear to form a unit substation.

Substations are available as a complete package or as individual units. Control compartments of like size are interchangeable anywhere in the panel.

Allis-Chalmers Mfg. Co., Milwaukee 1. Wis. Circle 462

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# Hy-Power by HANNIFIN 5,000 PSI HYDRAULICS

#### Proved by more than 25 years use in the Automotive Industry



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EVER
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FAST . QUIET . POWERFUL ... EASY TO MAINTAIN



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Used for riveting, punching, pressing, marking and press-fit assembly

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#### HANNIFIN COMPANY

519 South Wolf Road • Des Plaines, Illinois

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#### TOOLS of today

#### Wire Joiner

Continuous wire feeding is produced with a resistance butt welder in a wire joiner which eliminates time delay from reel changing and wire threading in submerged arc welding and other operations using coil-fed wire.

The joiner splices wire in sizes from %4 to %2-in. diam in one to six seconds. The welder automatically applies current to wire ends placed in tongs, upsets the joint, and shuts off at end of timed welding cycle. Flash cutter pliers, an accessory item, remove excess metal at the joint.

Lincoln Electric Co., Cleveland 17, Ohio. Circle 463

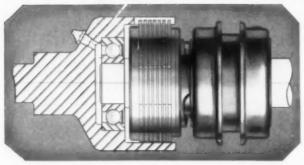
#### High-Speed Hand Grinder

High, full-load working speed is made possible in this portable hand grinder through a motor design feature that reduces no-load speed for longer bearing life and increases full-load speed for maximum production and



faster metal removal with either carbide burrs or mounted wheels. The Series 40 units provide sealed-for-life bearing lubrication, shock-absorbing flexible coupling that isolates armature from shocks imposed by cutting tools, and rapid heat dissipation. Specifications of the grinder include a power rating of 1/4 hp (continuous-duty), noload speed of 35,000 rpm and collets of 14 and 1/8 inch. A bracket accessory permits rigid, vibrationless lathe mounting for high-precision internal grinding.

The Dumore Co., 1300 17th St., Racine, Wis. Circle 464





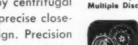


Heavy Duty Spring Loaded

### **SPECIFY PRECISION BUILT PULLMORE CLUTCHES**

PULLMORE CLUTCHES are not affected by centrifugal force or direction of rotation due to the precise closetolerance construction and compact design. Precision machining and grinding, proper hardening and the symmetrical contours of PULLMORE Multiple-Disc CLUTCHES insure perfect balance and smooth operation at both high and low speeds. They handle loads

of greater capacity when operated at high speeds and can be used both to drive and as a brake. Let our engineers help you determine the type and size clutch best suited to help improve the drive and brake control in your next model.



Send for This

Handy Bulletin

Shows typical



Oil or Dry





#### ROCKFORD Clutch Division BORG-WARNER

= 1329 Eighteenth Ave., Rockford, III., U.S.A. =

#### Gun Drilling Unit

High-speed gun drilling operations on conventional turret lathes can be done with the Model 3-203 unit. It installs on either ram or saddle type turrets, has a 34-inch bore spindle, and accommodates gun drills from 316 to 58inch diam. The gun driller provides a



choice of four spindle speeds: 765, 1150, 1405 and 2110 rmp. Overhang is 61/2 inches. A coolant inductor mounted on the opposite face of the turret provides a high-pressure coolant stream to wash chips out through the single straight flute of the gun drill. Coolant line quick-disconnect coupling permits turret rotation.

The Ward-Riddle Co., 241 Myrtle St., Ravenna, Ohio. Circle 465

#### Fillers for Plastics

Hollow spheres of silicone dioxide have a low density of four lb per cu ft, a 2300 F melting point and good floatability. Size of the resin-compatible filler is 300 to 600 microns.

Used alone or with binders, Globe-O-Sil microspheres are suitable as a material in insulation and mold reinforcement, or in adhesive, machineable casting and refractory applications.

Hastings Plastics, Inc., 1551 12th St., Santa Monica, Calif. Circle 466

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Air, Hydraulic Cylinders

Type AS air and hydraulic cylinders are available in bore sizes of 78, 11/8, 11/2 and 2 inches, as either double-acting or spring return, and double or single-ended. The cylinders have one piece square heads, ground and polished stainless steel rods, nylon bearings and honed brass or steel tubes.



Cushions are optional and a choice of packings is available. The units are stocked in strokes up to 20 inches, with strokes up to 168 inches available on order.

Allenair Corp., 255 E. 2nd St., Mineola, N. Y. Circle 467

#### Motor Control Units

High temperature silicon rectifiers provide a 300 percent increase in the surge safety factor in a line of motor controllers for industrial power appli-



cations. The drives for shunt motors are supplied in three sizes: junior for ½00 to ½-hp motors, size I for ¾, ½ and ½-hp motors, and size II for ¾, 1 and 1½-hp motors. Regulation is approximately ± 4 percent of base speed. Speed range is to 50:1 and vernier speed is adjustable. Remote or local control and dynamic braking and reversing are optional.

Magnetic Amplifiers, Inc., 632 Tinton Ave., New York 55, N. Y. Circle 468

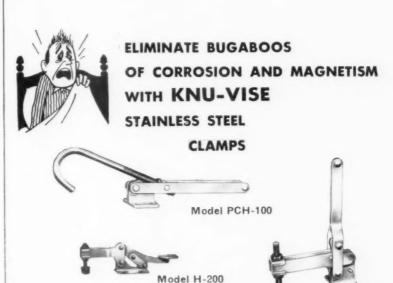
#### Push Action Toggle Clamp

Series C-150 square plunger, push action toggle clamps are available in three sizes: ½ inch (C-150), ¾ inch (C-151) and 1 inch (C-152). The units take loads up to 10,000 and have positive radial location of the plunger about the axis, large surface plunger area, and adapter pads that are easily mounted to the flat surface of the plunger. The broached guide hole and close plunger tolerance fit permit ac-



curate loading as well as clamping action.

Wolverine Tool Co., 1486 E. Woodbridge, Detroit 7, Mich. Circle 469 (Continued on page 188)



All shown 1/4 actual size

Model V-200

Knu-Vise stainless steel toggle clamps eliminate frustrating magnetic attraction and corrosion while spot welding, or while working near acids.

The complete stainless steel line contains 18 clamps with either horizontal, vertical, or T-style handles. There are types for side mounting and pull clamps as well. Write today for complete information. A standard or a special Knu-Vise clamp will probably be the answer to your application.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

#### KNU-VISE PRODUCTS

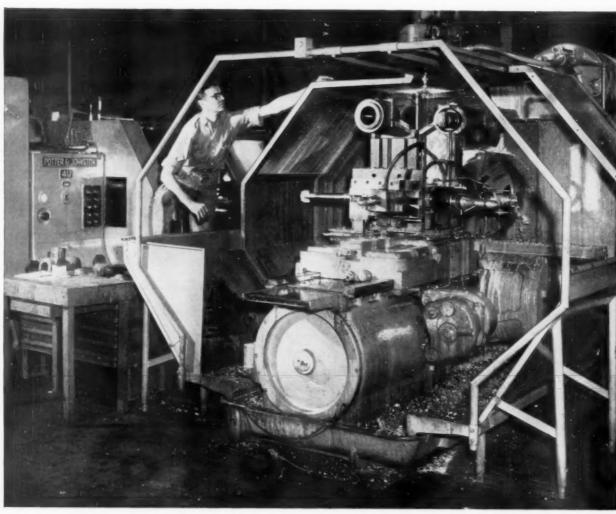
#### LAPEER MANUFACTURING CO.

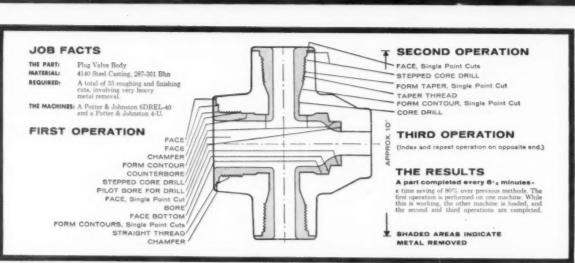
3053 DAVISON ROAD

WESTERN DIV.: PECK and LEWIS CORPORATION 4436 Long Beach Ave., Los Angeles 58, Calif., ADams 3-7146 CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD, 1131 Pettit Road, Burlington, Ontario

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## "Valve Bodies machined





### in One-Fifth the time

### ...plus attractive savings in set-up time!"

Two Potter & Johnston Automatic Turret Lathes . . . a Model 4-U and a Model 6DREL-40 recently installed in the Mission Manufacturing Company's plant at Houston, Texas ... are now producing plug valve bodies in 20% to 50% of the time previously required using hand turret lathes. Widely used in oil field and chemical industry applications, these valve bodies are machined from heavy steel castings. The multiple machining operations require very heavy metal removal, demand close tolerances and, in addition, involve the generating of complex internal contours. Looking for a means of speeding up these machining operations, Mission investigated Potter & Johnston and other makes of machines. P&J Automatics were finally selected, because they are sturdier and heavier and because of the extreme savings in the set-up time for the various jobs. Other factors influencing Mission's choice include the accuracy of the P&J Machines, the savings in floor space made possible by their high output-per-area, and the fact that their completely automatic operation insures greatly increased production per man-machine hour.

Combining extra power and rigidity for fast metal removal with the versatility needed to handle complex multiple cuts with speed and efficiency, Potter & Johnston Automatics can increase productivity and cut costs at your plant the same way they have at the Mission Manufacturing Company. For the dollars-and-cents facts, ask for production estimates on your jobs. Call the Pratt & Whitney Branch Office in your area or write direct, outlining your production needs.

PRATT & WHITNEY COMPANY, INC., 16 Charter Oak Boulevard, West Hartford, Conn.

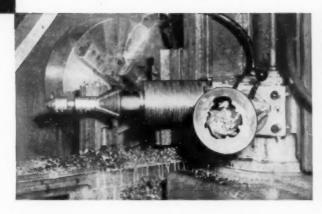
#### POTTER & JOHNSTON AUTOMATICS

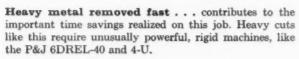
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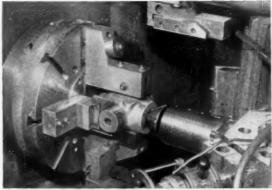


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FIRST CHOICE FOR ACCURACY
MACHINE TOOLS . GAGES . CUTTING TOOLS







Important savings in set-up time . . . are realized because this tooling, designed by P&J Specialists working with the manufacturer, incorporates an unusual degree of versatility and adaptability.

#### **TOOLS** of today

#### Belt Sander

Dust free sanding is accomplished with this Model 445 four-inch belt



sander. The vacuum dust pickup attachment is 90 percent efficient in sanding resins, lead or wood. Clogging of the unit is minimal and design allows flush sending up to vertical surfaces.

Skil Corp., 5033 Elston Ave., Chicago 30, Ill. Circle 470

#### Air Cylinders

Model A air cylinders in  $1\frac{1}{2}$  to 14-inch bores are rated for up to 750 psi operation, depending on bore size. Included in the line are these sizes and

units of pressure: 1½ and 2-inch bores, 750 psi; 2½-inch bore, 500 psi; 3½-inch bore, 750 psi; 4, 5 and 6-inch bores, 400 psi; 8, 10 and 12-inch bores. 250 psi. The higher ratings have no effect on the low-pressure operation of the cylinders. They cycle smoothly at pressures as low as 2 psi.

Miller Fluid Power Div., Flick-Reedy Corp., York and Thorndale Rds., Bensenville, Ill. Circle 471

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

#### Roughing Holders

Wheel boring tools with screw-on type round button inserts fit four-tool type "L" bars for rough boring. Style CDH-42 heavy-duty Kendex inserts with 1-in. diam cutting edge can be rotated to a new edge without disturbing the RWR holder setting. The inserts can be resharpened by grinding the top surface.

Eleven holders are stocked, with inserts made in two grades and chip breakers available.

Kennametal, Inc., Latrobe, Pa. Circle 472

#### Right-Angle Drive Gear

Packaging equipment, turntables, conveyor rollers and other industrial equipment can be operated with this floating gear drive, which provides



power transmission at right angles with a 1:1 ratio. To install the drive, gears and housings are assembled around the shaft, eliminating the need for separate couplings, supports and alignment.

Tol-O-Matic, Inc., Minneapolis, Minn. Circle 473

#### Metal Working Machine

Metal sheet and plate can be machined with this Swedish GV junior unit with an edge-cutting capacity of \( \frac{3}{3} \) inch in mild steel. Throat depth is

### ACCURACY ASSURED...





2814 inches. A full line of tooling is available for straight, circle, figure and slot cutting, beading, folding, louvering, nibbling, planishing and flanging.

Homestrand Machine Tool Corp., 392 W. Putnam Ave., Greenwich, Conn. Circle 474

#### Large Frame Power Units

Extension of frames in a line of industrial motors, generators and motor-generator sets provide NEMA frame sizes 584A, 585A, 683A and 684A, resulting in 28 additional drip-proof motor ratings and 14 drip-proof generator ratings. Increased versatility of the line makes possible a wider range of applications on machine tool drives.

General Electric Co., Schenectady 5, N. Y. Circle 475

#### Photoelectric Proximity Sensor

Energy source and detector are combined in a single unit, the SA-IR infrared photoelectric scanner, 2½ inches long by 1½ inches in diam. The unit will sense objects or control areas at distances up to two inches. It responds to metallic and nonmetallic objects, is easily installed, and handles a wide variety of counting and control operations.



Life rate of the infrared source is 60,000 hours at 5 volts a-c. Housing provides for mounting in a single <sup>3</sup>4-inch hole. Auxiliary equipment is available.

Former Electric Products Co., Inc., 2300 Washington St., Newton Lower Falls, Mass. Circle 476

#### Bar Machine Attachment

A wide variety of end operations can be performed with this three-spindle universal attachment for automatic bar machines. Mounted on a horizontal seat, the attachment is longitudinally adjustable to accommodate various



workpiece lengths, provides a large chip clearance area, and has an increased spindle stroke and increased spindle clearance for larger tool holders. The large, heavier spindles provide high rigidity and are completely interchangeable to permit drilling, threading or tapping in any of the three positions. A spindle brake is optional.

American Bechler Corp., 28 Harbor St., Stamford, Conn. Circle 477

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

### with PRATT & WHITNEY GAGES



"JOB ENGINEERED" MACHINE TOOLS . GAGES . CUTTING TOOLS

Use Reader Service Card, CIRCLE 94

#### TOOLS of today

#### Heavy-Duty Dresser

Suitable for all dressing on medium and large wheels, and particularly



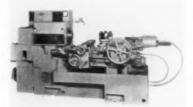
adapted for wide-faced wheels, this No. 22 dresser has 23/g-inch diam cutters and a 2-inch cutting face. The bearing assembly furnishes six bearing holes and blocks that are easily indexed to present new bearing surfaces. Cutters are easily changed without removing the cutter assembly from the head.

Machine Products Corp., 125 Hollier St., Dayton 3, Ohio, Circle 478

#### Automatic Turret Lathe

Minganti Model 50E is an automatic cycle turret lathe with an electro-

mechanical preselection system which is simple, economical and effective in operation. Spindle speeds and feeds in all

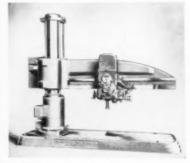


directions for the full cycle are preset by positioning of keys on the control panel. The camless process also provides semiautomatic setting which is instantly adjustable to the automatic cycle.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N. Y. Circle 479

#### Radial Drills

Medium duty, high-speed radial drills are available in column sizes from 13 through 19 inches diam, with arms from 5 to 14 ft in length. In addition to manual feeds, the head provides 12



spindle speeds with 3 optional ranges, plus 6 power feeds with two optional ranges. The units will drill, face and bore, and tapping can be done without additional equipment.

The American Tool Works Co., Pearl St. at Eggleston Ave., Cincinnati 2, Ohio, Circle 480

#### Variable Volume Pumps

The movable cam ring principle for automatically adjusting volume to demand while maintaining constant pressure, is employed in a line of four variable volume pumps which operate at 500 psi, 7 gpm or 1000 psi, 6.5 gpm. The pumps are used in hydraulic systems when efficiency under varying operating conditions is an important consideration. They deliver only the amount of hydraulic fluid necessary at a constant pressure for the load at any given instant.

The DoAll Co., Des Plaines, Ill. Circle 481



Triple Tempering makes SOSSNER taps the toughest taps going. This extra toughness gives you longer life plus trouble-free performance. You get greater resistance to chipping and breaking. Prove it to yourself! Try SOSSNER taps with extra toughness at no extra cost.

SOSSNER TAP & TOOL CORPORATION
29 BROADWAY + LYNBROOK, L.I. N.Y.
FACTORY WAREHOUSES IN NEW YORK + LOS ANGELES + ST. LOUIS + DALLAS

Use Reader Service Card. CIRCLE 95

### technical shorts

Successful experimental extrusion of commercially pure vanadium tubing, a metal particularly suited for chemical and process plant applications, was announced recently

by the Wolverine Tube Division of Calumet & Hecla, Inc. Seamless vanadium tubing, is expected to be val-

Successful Extrusion of Vanadium

uable in the nuclear and process industries because of the unusual combination of low weight, high-temperature strength and corrosion resistance possessed by the metal vanadium.

Until recently, impurities in vanadium have made it too brittle to be extruded. However, the introduction of the ductile form of vanadium and a new extrusion process has made seamless tubing possible. The new extrusion process was developed by Wolverine Tube engineers in cooperation with Oregon Metallurgical Corp., Albany, Oregon.

Diamond Research Laboratory in Johannesburg has installed a high-voltage electron accelerator for use in the study of diamonds. Able to propel electrons at velocities up to

the speed of light. the accelerator is capable of extremely high output on an aroundthe-clock basis.

Electronic Research on Diamonds

Because hardness, electrical conductivity, surface structure and other qualities of diamonds can be altered by extended electronic bombardment, the accelerator is expected to open new fields to the diamond industry.

Process for attaching flanges to waveguides and other electronic components without the use of heat has been developed by Allied Research & Engineer-

ing Div. The process involves fitting the flange onto the waveguide after which nickel or copper is electrodeposited over the

Electrodeposition Replaces Brazing

entire joint. Because electrodeposition is performed at room temperature, no distortion of components due to heat

This electrodeposition process has re-

cently been used to attach flanges to long runs of Invar waveguide tubing as part of telemetering equipment used in ICBM monitoring. Originally, flanges were to be silver soldered to five-foot lengths of Invar tubing which had to conform to rigid dimensional tolerances. However, the heat required for soldering and brazing caused distortion and cracking of the tubing. Oxidation of the surface with an attendant destruction of thermal properties also resulted. Electrodeposition of nickel and copper was found a solution to this problem.

Agreement within one-millionth of an inch on the dimensional value of a four-inch gage block by the national standards laboratories of England,

Germany and the United States, as well as that of Sheffield's Corp.'s Eli Whitney Metrology Laboratory has been an-

Gage Block Measured to One Millionth of an Inch

nounced. Three of the laboratories measured the block to within one-tenth of a millionth of an inch.

This agreement, obtained during an international laboratory calibration test, portends accurate measurement to the seventh decimal on a commercial basis. An ever increasing number of parts used in missile, aircraft and atomic energy industries require dimensional tolerances of this order.



### FIVE Interchangeable COUNTERBORE SETS

RADIAL DRIVE

Set No. 13 - 116 Combinations

Set No. 14 - 149 Combinations Set No. 15 - 291 Combinations

Set No. 11 — 130 Combinations Set No. 12 — 273 Combinations

AT AN AVERAGE COST OF ONLY \$1.25 PER COMBINATION!

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give tubing, pipe, structural shapes and solids the contour you need for the use intended. That is why production men have been bringing bending problems to Wallace since 1896. It is the time-proved way to bend a production curve upward and a cost curve down.



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serve outstanding metal fabricators the world over, many of them exclusively. The complete Wallace line includes ram benders, rotary and roll benders, automatic and manually operated, in the widest range available. For the job you do, Wallace builds the bender.



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# .....readers' viewpoints

#### . . . belles lettres

To the Editor:

This is to call your attention to the fact that on page 86 of the March issue of THE TOOL ENGINEER there exist some disturbing errors. Specifically, I refer to the middle line of Reference 2. Four errors in one line seems statistically unlikely.

- An apostrophe is not an acute accent.
- "de ondes" is ungrammatical. This must be either "d'ondes" or "des ondes."
- "chos" surely is wrong. "choc" was probably intended.
- "Dendus" cannot be correct.
  "Rendus" (rendered) is customary. "Pendus" (hanged, plural) might be appropriate for having allowed these barbarisms to be printed.

Francois Arouet Lyon, France

Touché. THE TOOL ENGINEER stands corrected.—Ed.

#### . . . gadgets award

To the Editor:

We note with more than casual interest—in fact with pride and satisfaction—that first prize in the Gadgets Contest was awarded to one of our former students, Edward Bennett of Northern New Jersey Chapter 14. As a student Mr. Bennett showed marked ability in the engineering field.

Your statement that he joined ASTME as a student in Bridgeport, Conn. was only partially correct. He spent his student days at this school joining Fairfield County Chapter 6 as an undergraduate.

We are most proud to claim Ed Bennett as one of our graduates.

Colonial School of Tool Design E. E. Durlach, Manager

#### . . . suppliers directory

To the Editor:

Here at Utah State we believe that the T.M.E. should know of, have ready access to, and be able to use to the fullest advantage, catalogues and technical reference material. He should have a knowledge of equipment, accessories, materials and supplies, and costs. To assist him in obtaining this information we keep a set of filing cabinets for catalogues and for technical literature, and shelves for current

engineering and science journals.

We have recently overhauled our filing for catalogues and technical literature, using The Tool Engineer Suppliers Directory to guide our filing system. We are using the products listing to bring us up to date. A small 5 by 7 card is used alphabetically for the products listings. These cards tell us products and company names. These cards are starred according to our courses and teaching interests, and also tell us if we have catalogue material available in our catalogue files.

In the manufacturers listing, we have found new sources of supplies and technical information. The Tool Engineer Suppliers Directory has given us many new sources of material and technical information and has given us an increased awareness of valuable materials which can be made available to T.M.E. students.

Frederick Preator Head, Tool and Manufacturing Engineering Dept. Utah State University

To the Editor:

Thank you very much for your letter of Februrary 15 in regard to the Suppliers Directory. We appreciate the attention given to small companies such as ours. Most directories usually shuffle over us in favor of the more publicized names.

National Diochemical Co. J. Swimmer

To the Editor:

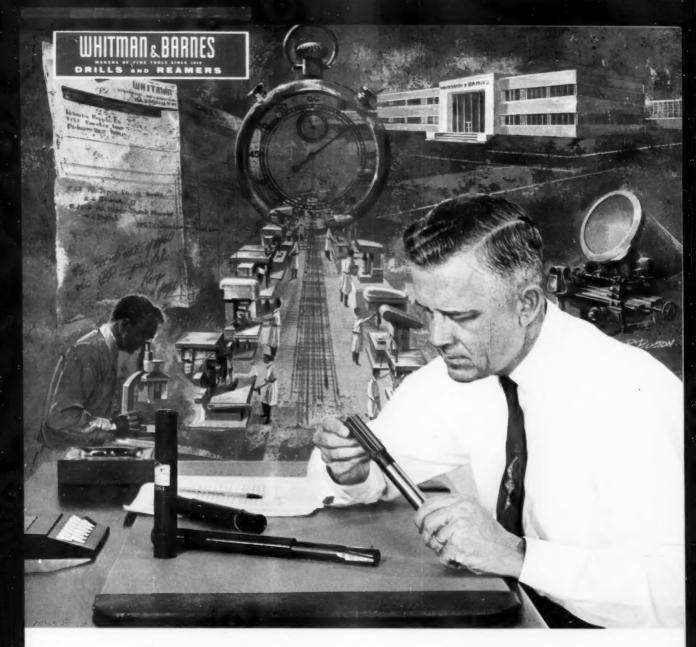
In looking at the Suppliers Directory we find several firms and individuals listed in the pink section (sales offices) who are operating businesses quite similar to ours.

We operate as manufacturers representatives in the aviation, electronics and industrial fields. We also represent a firm that produces a special type of patented cast iron used extensively in tool and die manufacture.

We are wondering what system you use to complete the information shown in your directory. If any special forms should be completed, please see that they are supplied to me at this time so that they can be properly filled out and returned to you in time to be included in the next Suppliers Directory issue.

R. E. Dahlin Manufacturers Representative Dallas 21, Texas

By way of answering many such queries, names of sales offices and authorized representatives are published from information supplied by the manufacturers themselves.—Ed.



### There's more to the buy than meets the eye

How do I know? We had a finish problem in reaming cast steel. Best finish we were getting was 150-175 micro-inch. We needed 60 or better. A W&B Service Engineer came in with one of their 1-1/16" Chucking Reamers. He checked feeds and speeds—finally came up with .011 per revolution and 60 SFM. He recommended a secondary grind on the chamfer to assure clearance, then added a second chamfer of 67%. We were able to get and maintain a reamed finish of 40-50 micro-inches. At the end of the day, the operator was

getting all good parts and saving substantial time per piece. In a case like ours, W&B's technical help, service and consistent reamer quality really convinced me that initial

price is merely one factor. Find out for yourself . . . test W&B tools in *your* plant under *your* conditions. Call them in direct or through your industrial distributor. Do it today. See if *you* can't get better results.

PARTNERS IN PRODUCTION PROGRESS

### WHITMAN & BARNES

40000 PLYMOUTH ROAD . PLYMOUTH, MICHIGAN





### Reduce Tip Failures with W&B Perma-Braze Carbide Tools





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DISTRIBUTOR FOR...

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PROMPT DELIVERIES



FREE LITERATURE
on carbide tools—write today!

Perma-Braze is an advanced process pioneered and perfected by Whitman & Barnes that enables carbide tips to be brazed with a specially developed high temperature alloy at the same time the high speed bodies are hardened. The result is uniform body hardness and carbide tips that will not loosen due to braze melting. Your payoff is greatly reduced tip failures . . . less machine down-time . . . longer tool life. You get lower tooling costs and a more efficient operation. Ask your W&B distributor about Perma-Braze carbide tools today!



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### WHITMAN & BARNES

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# rade iterature

for free booklets and catalogs—use request card, page 175

ALL TYPES OF MACHINERY MOUNTS are described, with data on loading ranges, vibration transmissibility and application, in a six-page bulletin. Unisorb Div., The Felters Co. (Circle 301) ... Three high-speed metal parts forming machines are described in an illustrated, 16-page catalog. The Cyril Bath Co. (Circle 302) . . . A 25-minute 16 mm sound film in color, which describes a line of heavy-duty, floor type threading machines, is available free on a loan basis. The Oster Mfg. Co. (Circle 303) . . . Information on multiplesurface, porous stainless steel filters is available in an eight-page bulletin. Micro Metallic Div., Pall Corp. (Circle 304) . . . Low-cost anticorrosion treatment for bare metal, plated and painted surfaces is presented in an illustrated, eight-page folder. Corrosion Reaction Consultants Inc. (Circle 305) . . . Standards specifications book for industrial lighting units, 1960 edition. contains 52 pages of new and existing specifications. The RLM Standards Institute. Inc. (Circle 306) . . . In 12 illustrated pages, bulletin 591 presents the manufacturer's complete line of nonferrous metal melting furnaces. Hevi-duty Electric Co. (Circle 307) . . Engineering facilities and services used in the production of castings from a wide range of iron alloys are presented in a 12-page, four-color, illustrated brochure. Hamilton Foundry Inc. (Circle 308) . . . Stock sizes of more than 2000 sizes of roller chains and five types of sprockets are listed in a 44-page book, No. 2757. Link-Belt Co. (Circle 309) . . . A new line of cylindrical roller bearings is detailed in 12-page bulletin No. 114. Hoover Ball and Bearing Co. (Circle 310) . . . Twenty-four page catalog B-60 presents advantages and applications of the various types of belting in the company's line. Service Div., Maurey Mfg. Corp. (Circle 311) . . . An expanded line of permanent magnet pulleys for tramp iron removal, separation and cobbing operations is described in six-page, illustrated bulletin No. 1022. Stearns Magnetic Products. (Circle 312)

#### Adhesives

A condensed catalog describes a line of

adhesives, laminating materials, putties and sandwich core. Narmco Resins & Coatings Co. (Circle 313) . . . A file-tabbed, 16-page catalog covering structural adhesives is available only by writing on company letterhead to 900 Bush Ave., St. Paul 6, Minn. Adhesives, Coatings and Sealers Div., Minnesota Mining and Mfg. Co. (Circle 314)

#### Bending

Ram benders for forming iron pipe and channels and bars of steel, copper, brass, stainless and monel are described and illustrated in a 16-page catalog. Wallace Supplies Mfg. Co. (Circle 315)

#### Boring, Drilling & Tapping

An informative, four-page folder on countersinking illustrates and describes four types of countersinks-high-speed steel, single flute and three flute; and carbide-tipped, single flute and three flute. Cleveland Twist Drill Co. (Circle 316) . . . A 42-page bulletin describes and illustrates a line of vertical boring mills ranging in capacities from a swing of 7 ft to more than 42 ft. Consolidated Machine Tool Div., Farrel-Birmingham Co., Inc. (Circle 317) ... An eight-page brochure and a 36page operations manual describe a line of single, twin and opposed spindle boring, turning and facing machines. Industrial Machinery Div., American Electronics, Inc. (Circle 318)

#### Broaching

Catalog B60-1 describes and illustrates a variety of self-contained, air-powered broaching fixtures, typical applications and production data. National Broach & Machine Co. (Circle 319) . . . A four-page folder lists complete specifications and operating instructions for a line of 55 push type broaches, California Broach Co. (Circle 320)

#### Cleaning

Brochure PC-355 describes an industrial machine cleaner that can also be used as a degreasing solution. Products Div., Cincinnati Milling Machine Co. (Circle 321) . . . Ultrasonic cleaning and rust-proofing are discussed in a 22-

page catalog which details the company's products. Rust-Lick, Inc. (Circle 322)

#### Chucks

Thirty-two page manual contains scale drawings showing the application of Speed-grip chucks to screw machines, chucking machines, lathes, balancing machines, gear hobbers, finishing machines, gear shapers and shavers, internal grinders, boring machines, inspection machines and fixtures. Speedgrip Chuck Div., Ernest Holdeman & Collet, Inc. (Circle 323)

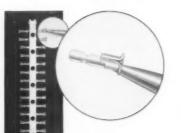
#### **Cutting Tools & Holders**

Data file AT-61 catalogs a line of 27 models of recessing tools for internal machining. Maxwell Industries. Inc. (Circle 324) . . . Bulletin T-160 describes three lines of holders for use with carbide inserts and provides specifications, applications, ordering and dimension data for each series. Wesson Co. (Circle 325) . . . Twelve-page bulletin A-50-5 incorporates information, illustrations and charts pertaining to tangential die head chasers. Landis Machine Co. (Circle 326) . . . Bulletin No. MF-260 provides 26 pages of information about the company's standard lines of carbide throwaway and on-end inserts, carbide blanks and brazed single-point tools. Wesson Co. (Circle

#### Electric Motors, Controls & Drives

Information and data on type MD replacement coils, which are manufactured to original size and electrical design, are contained in bulletin GEA-7014. General Electric Co. (Circle 328) . . . Folder 2875, pertaining to MC geared flexible motor couplings, contains an additional leaflet describing three new features of the line. Link-Belt Co. (Circle 329) . . . An eightpage, illustrated brochure describes Varidyne a-c controlled speed systems. U. S. Electrical Motors, Inc. (Circle 330) . . . Application data sheet No. 6 describes the way in which step-function speed reductors were used at Acton

# Precision ELECTRICAL and ELECTRONIC COMPONENTS by the MILLIONS...



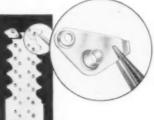
### with



# TERMINALS 420 PIECES PER MINUTE 10 station, double die ribbon, .020" brass, cutoff produces 4 completed pieces per stroke at 105

strokes per minute.

### PROGRESSIVE DIES



#### TERMINALS

200 PIECES PER MINUTE

15 station die ribbon, .032" brass, cut-off produces 2 pieces per stroke at 100 strokes per minute.

These two progressive die ribbons show design ingenuity that pays off in precision and production.

B. Jahn dies are Production Proved before delivery guaranteeing components that meet every assembly specification and product quality requirement.

For precision, ingenuity and mass production economy—produce the best with B. Jahn.

Send for B. Jahn "Case History" brochure—no obligation, of course.





THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT

Use Reader Service Card, CIRCLE 99

#### Trade Literature

Laboratories, Inc. Insco Co. Div., Barry Controls, Inc. (Circle 331) . . . A letter-size file folder binds a 28-page catalog that lists hundreds of geared and nongeared electric motors from 1/2000 to 25 hp with speeds of from 0.65 to 10.000 rpm. B & B Electric Motor Co. (Circle 332) . . . GEA-6424A discusses benefits and features of a line of fractional-hp Form G general purpose mo-tors. General Electric Co. (Circle 333) Eight-page brochure P-75 details a line of standard, special and custom electric controls used to actuate the company's brakes and clutches. Warner Electric Brake & Clutch Co. (Circle 334) . . . GEA-700 is a two-page bulletin describing a new drum switch for control of single-speed electric motors up to two hp. General Electric Co. (Circle 335)

#### **Fasteners**

"Unbrako Socket Screw Catalog and Engineering Standards" provides a technical reference of 82 pages, with standard catalog data and extensive design and performance information on a line of fasteners. Standard Pressed Steel Co. (Circle 336)

#### Finishing & Grinding

"Diamond Data" is a new technical periodical available to management, purchasing executives and shop or toolroom personnel in abrasives, toolmaking, metalworking and other industries. Industrial Diamond Div., Engelhard Industries, Inc. (Circle 337) . . . "Old As The Hills" is a 16 mm sound color film, available on a free loan basis, that tells the story of abrasion from its earliest natural beginnings through present-day technological applications. Norton Co. (Circle 338) . . . Fluid motion wheel dressers that dress two angles tangent to a radius in one continuous motion are described and illustrated in an eight-page folder. J & S Tool Co., Inc. (Circle 339) . . . A four-page brochure describes and illustrates a new electrochemical machine tool for sharpening carbides. Everite Machine Products Co. (Circle 340) . . . A line of 49 jobmatched rubber-cushioned abrasive compounds, with methods and application data for the products, are covered in a 16-page catalog. Brightboy Industrial Div., Weldon Roberts Rubber Co. (Circle 341) . . . Preliminary technical bulletin No. DCG-1 covers a new deburring and chamfering grinder for spur, helical and bevel gears. Michigan Tool Co. (Circle 342) . . . A 10minute, 16 mm color sound film shows

the operation of an automatic drill point grinder. Winslow Product Engineering Co. (Circle 343)

#### Fluid Power

Automatic split-body control valves and accessories are reported in a 20-page, illustrated catalog. Write to Hammel-Dahl Div., General Controls Co., Warwick, Rhode Island. . . . Cartridge type control valves are described and illustrated in a four-page bulletin. Humphrey Products Div., General Gas Light Co. (Circle 345) . . . Three-position, fourway dual solenoid valves are detailed in bulletin 8347. Automatic Switch Co. (Circle 346) . . . Announced in a sixpage bulletin, No. 458, is a series of light weight, extra compact, solenoid operated, 11/s-inch bore cylinders for air, oil or water operation in tooling and automation applications. The Sheffer Corp. (Circle 347) . . . Bulletin 1530B1 explains why and how accumulators are used in a wide variety of hydraulic systems, and details a line of piston type units that range in capacity from 10 cu in. to 10 gal. Parker Hydraulies Div., Parker-Hannifin Corp. (Circle 348)

#### Gears

Capabilities of the company's Mechanical Div. in designing fabricating and checking high precision gears and gear trains are described in a four-page folder. Mechanical Div., General Mills, Inc. (Circle 349)

#### Heat-Treating, Brazing & Soldering

Lead article of "Heat Treat Review," Volume 11, No. 1, is devoted to a discussion of nonferrous metal heat-treating and the application of prepared gas atmospheres. Surface Combustion Div., Midland-Ross Corp. (Circle 350)

#### **Indexing Units**

Series J miniature turret indexing units are described and illustrated in a 40-page bulletin. Swanson-Erie Corp. (Circle 351)

#### Inspection & Measurement

A line of four machines for laboratory and production shock testing is described in a four-page folder. Barry Controls Inc. (Circle 352) . . . Bulletin 1626 provides information on Type 4-327 pressure transducer for measuring gage and absolute pressures to 5000 psi. Consolidated Electrodynamics Corp. (Circle 353) . . . Details of the Type SA-IR photoelectric scanner (proximity sensor) are given in bulletin 260. Farm-

ALLI

The cost of ALLEN Hex-Socket Cap Screws is only a minor fraction of your assembly costs... be sure you're getting the timesaving, cost-saving advantages of genuine Allens!

Ever since Allen first produced the hex socket head screw nearly fifty years ago, specifying *genuine* Allens (made by Allen of Hartford) has been a sure way to guarantee dependable threaded fastening.

Only genuine Allens have Leader Points that make starting easier, and greatly minimize danger of cross threading. Genuine Allens are "pressurformd" to preserve the long fibers uncut throughout the length of the screw, giving stronger sockets for greater tightening torque.

Write for samples and engineering data. See how *genuine* Allens will make your product better.



Allen's new 1960 Series Socket Head Cap Screws give up to 2½ times more load carrying capacity, without indentation.



Head diameter of sizes from ½" up is now uniformly 1½ times the body diameter—providing more under-the-head bearing surface, and a proportionate increase in clamping force. Write for new Bulletin G-25, with full specifications.

Stocked and sold by leading Industrial
Distributors everywhere



ALLEN MANUFACTURING COMPANY

HARTFORD 1, CONNECTICUT, U.S.A. Use Reader Service Card, CIRCLE 100

### **O-M Cylinders Hold Every Stroke to** a Close Tolerance



Regardless of the bore size, diameter of rod, length of rod travel, type of mounting and position in which they are mounted, O-M Cylinders operate with high reliability and precision with every

Made of all-steel with bearing bronze; these force generating components take shock loads in stride, cushion piston shock and stand up under continuous cycling. In addition, they are sealed right, have the lowest coefficient of friction, make full power starts and require little maintenance

maintenance.

Available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Complete line of mounts and interchangeable parts. Immediate delivery on most sizes. Mail Coupon NOW for descriptive Bulletins.

-

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			105A		108
Name			Posit	ion	

#### Trade Literature

er Electric Products Co., Inc. (Circle 354) . . . New version of the "Basic Guide to Ferrous Metallurgy" provides information in a durable, easily read form. Tempil Corp. (Circle 355) . . . Electromanometer system for precision pressure measurement is described in a four-page brochure. Consolidated Electrodynamics Corp. (Circle 356) . . Mikrom comparators, interchangeable heads and accessories are described in a two-page folder. Mueller Gages Co. (Circle 357) . . . Newly revised data sheet, "Instructions for Using Tempilstiks," lists the complete line of temperature measuring devices and new temperature ratings. Tempil Corp. (Circle

#### Lubrication & Cooling

A small sample tube of Type G grease consistency lubricant accompanies bulletin 126B, which describes industrial applications of the lubricant. Alpha-Molykote Corp. (Circle 359) Poxylube, a bonded dry film lubricant, is presented in a four-page brochure. Poly Chem. (Circle 360)

#### Materials

Physical properties, fabrication characteristics and economic advantages of a wide variety of aluminum alloys in varied forms are listed in a 24-page selection guide. Olin Mathieson Chemical Corp. (Circle 361) . . . Commercially available powders used in powder metallurgy are detailed in a 22-page technical data directory. Write Metal Powder Industries Federation, 60 E. 42nd St., New York, N. Y. . . . Molybdenum mill products specifications are covered in a 22-page booklet. Universal Cyclops Steel Corp. (Circle 363)

#### Metallizing

"Coatings for Vacuum Metallizing" is a 45-page booklet that details the application and use of vacuum metallizing coatings. Logo Div., Bee Chemical Co. (Circle 364) . . . Engineering data on coatings of metals, ceramics, carbides and other high melting point materials are covered in an illustrated, 16-page booklet. Metallizing Engineering Co. (Circle 365)

#### Milling

One, two and three-dimensional models of hydraulic tracer mills, which operate either manually, semi or fully automatically, are illustrated and detailed in an eight-page catalog. Famco Machine Co. (Circle 366)

ACTUAL **MANUFACTURERS** OF RESINOID METAL AND VITRIFIED DIAMOND WHEELS UP TO AND INCLUDING 24" DIAMETERS

Call or write for literature today!



THE PAUL L. KUZMICK COMPANY 271-279 GROVE AVE. VERONA. N.J.

MANUFACTURERS OF RESINOID AND RUBBER BONDED WHEELS SERVING THE AIRCRAFT, CUTLERY AND STEEL **FABRICATING** INDUSTRIES.

> Call or write for literature today



PEKAY ABRASIVES, INC. 271 GROVE AVE. VERONA, N.J.

Use Reader Service Card, CIRCLE 102 The Tool Engineer

#### Portable Power Tools

The "500" line of consumer power tools and a 1960 listing of industrial power tools are covered in two catalogs, one with 24 pages and the second with 64 pages. Skil Corp. (Circle 367)

#### Pressworking

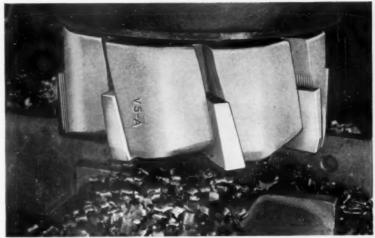
Dimensions, capacities, specifications and prices of eight motor driven stock reels for coil handling applications are covered in a four-page catalog. Durant Tool Co. (Circle 368)

#### Punches & Dies

Data sheet No. 60 deals with a new line of punches and lists specifications for hole sizes for metal screws, rivets and other fasteners. Dayton Perforators, Inc. (Circle 369) . . . Retainers, punches and die buttons are described and illustrated in a four-page bulletin. Atlantic Special Products Div., Atlantic Tool & Die Co. (Circle 370) . . . Catalog No. U-95 describes a heavy-duty series of unitized tooling for metal fabricating. Tool Products Corp. (Circle 371)

#### Welding, Soldering & Brazing

Lowering of production and machining costs through precisioned flame cutting is described in a six-page brochure. Steel Warehousing Div., Jessop Steel Co. (Circle 372) . . . Seven electrode data sheets for Sureweld a-c and d-c electrodes include four for electrodes used in mild steel welding, one for medium carbon steel, one for high carbon steel and one for railwear. National Cylinder Gas Div., Chemetron Corp. (Circle 373) . . . A comprehensive, 40page illustrated manual provides a complete survey of aluminum welding, brazing and soldering. All-State Welding Alloys Co., Inc. (Circle 374) . . . Bulletins NH-175 and NH-178 present features, specifications and optional equipment available with four Sureweld SU series a-c arc welders. National Cylinder Gas Div., Chemetron Corp. (Circle 375) . . . The manufacturer's complete line of welding electrodes, gas welding rod, nonconsumable electrodes, submerged welding flux and automatic welding wire are covered in a 26-page. illustrated catalog. Hobart Brothers Co. (Circle 376) . . . Precise data on resistance welder transformers, with schematic diagrams, drawing, charts and graphs, are contained in a 20-page technical brochure, SP-23. The Taylor Winfield Corp. (Circle 377) . . . Twelve data sheets include specifications for the company's filler rods, and list procedures for welding and brazing as well as typical applications. National Cylinder Gas Div., Chemetron Corp. (Circle 378)



O K END MILL WITH VSA SUPER HIGH SPEED STEEL BLADES

### carbide - not for every job...

The low transverse rupture strength of carbide creates problems, especially on jobs involving intermittent milling. You will need sound tool geometry, firmness for machine, fixture and workpiece. We recommend blades of V5A super high speed steel. Write for data sheets. THE O K TOOL COMPANY, INC., 300 Elm Street, Milford, New Hampshire.



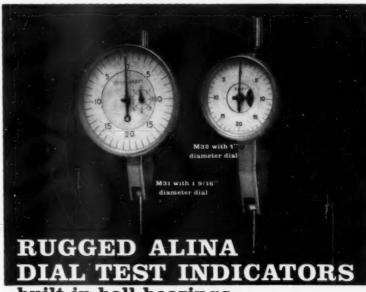
illing (



modern

milling machines

Use Reader Service Card, CIRCLE 103



built-in ball bearings

for greater sensitivity - reduced pressure - improved accuracy

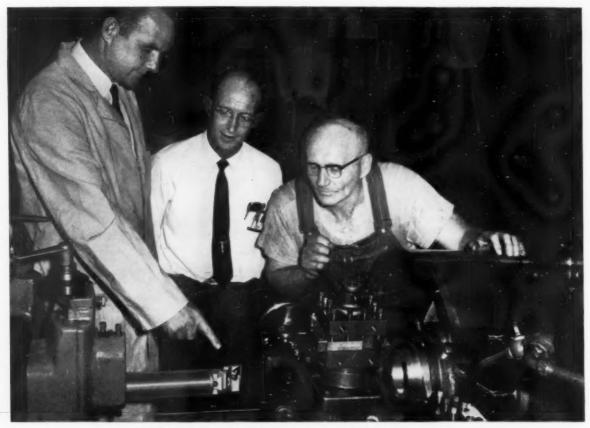
Jeweled Shock Proof Range .032" Graduated .0001"
 Reading 0.20.0 Fully reversible contact point.



Reading 0-20-0 • Fully reversible contact point
 Available with a wide variety of rectangular or round shanks.
 The instruments shown here are part of a complete line of precision
 DIAL TEST INDICATORS of all types — Write for brochure!

### ALINA CORPORATION 122 East Second St., Mineola, L.I., N.Y.

122 East Second St., Mineola, L. I., N. Y. Use Reader Service Card, CIRCLE 104



Kennametal Carbide Engineer, Tool Engineer and Machine Operator. This 3-Man Tooling Team found the answer to better boring operations at Gardner-Denver Company.

### This Adjustable Head KENNAMETAL K-Bar does the work of 5 "special" bars

Three bores on this 8620 steel casting chuck end previously required five special boring bars. Chatter and inability to hold size was a constant problem. Then the Kennametal Carbide Engineer suggested that one Kennametal K-Bar be tried for all

Although the test setup was not ideal (11-inch bar overhang), the K-Bar conclusively outperformed the five bars previously used. Increased machining speeds possible with the K-Bar produced the outstanding time reduction shown in the table. Substantial savings will also accrue through reduced tool maintenance.

In the tests, depths of cuts were varied from .001 to .500 but chatter could not be detected. The high rigidity of Kennametal (three times that of the hardest steel) made it possible to eliminate weaving, chatter and provided a better finish. Ask

your Kennametal Representative, or write us direct about our line of adjustable K-Bars with Standard Kendex inserts and chip breakers, seven sizes, 1-inch to 21/2-inch diameters. KENNAMETAL INC., Latrobe, Pa.

Material: 8620 steel casting

#### 3-bore operation:

4.470 bore -- .325 depth of cut 3.720 bore -- .290 depth of cut 3.220 bore -- .290 depth of cut

#### Actual machining time:

Original setup (5 special bars)

Kennametal K-Bar

3.1 minutes

16.7 minutes

TIME SAVED PER PIECE 13.6 minutes



Kennametal K-Bars PREVENT chatter, taper, weaving and drag-out scoring, Kennametal K-Bars PERMIT successful use of harder grades of carbide inserts, faster machining speeds.



NAMETAL Partners in Progress

Use Reader Service Card, CIRCLE 105

The Tool Engineer



Daniel C. McCarthy has been named administrative vice president of Pratt & Whitney Co., Inc. He comes to the company from the Mobile Oil Co. where he was assistant comptroller. McCarthy previously served with the Ford Motor Co. in both its Lincoln-Mercury and Ford Divisions and with two divisions of the Chrysler Corp. He received a BME degree from Cornell University in 1949.

Roland J. Fernekes has been appointed manager of manufacturing engineering at Landers, Frary & Clark. He will be responsible for methods, equipment, time study and plant layout, and will serve as liason between the engineering and manufacturing departments of the parent company and its subsidiaries. Fernekes has been production and chief methods engineer for the company.



### Men at Work



Leland C. Sharron has been recently appointed to a position in the Manufacturing Engineering Div. of Landers, Frary & Clark. He will be responsible for coordinating all tool making and tool designing for the division. Sharron was formerly plant superintendent for Alladin Tool and Die Co. and also served as chief process engineer for Dorset-Rex, Inc.

RICHARD HENDERSON has been appointed chief engineer for the Arcair Co., Lancaster, Ohio. He will be responsible for all product design, research and development for the company.

DAVID D. DRESBACK will replace RAYMOND NIXON, who is on extended leave of absence, as chief engineer at Beaver Tool and Engineering Corp. Dresback has spent 35 years in tool design, process engineering and machine design, and has extensive experience in special tooling applications for precision and general boring work.

New manager for the headquarters plant of Harnischfeger Corp., Milwaukee, Wis., is Joseph Surmacz, Carnegie Institute of Technology graduate, who joined the firm in 1951 as chief industrial engineer. Other appointments at Harnischfeger include that of David Drewery as director of production and industrial engineering and Robert Over to the post of superintendent of machine shops, heat treat, salvage and cutoff departments.

Dreis & Krump Mfg. Co. has appointed R. Johnson vice president and general sales manager. Johnson has been with the company for eight years, and was formerly sales manager of the tooling division.

RICHARD H. WHEELER has been named vice president-manufacturing of Warner Automotive Div., Borg-Warner Corp.

Wyman-Gordon Co., Worcester, Mass., manufacturer of forgings for industry, has named Joseph R. Carter, general manager, Eastern Div.; James L. Roach, director of marketing; and Robert E. Zell, general manager of the Ingalls-Shepard Div., as vice presidents of the firm.

LESTER V. S. SANSON has been appointed manager of the manufacturing and parts service division of Hughes Aircraft Company's Ground Systems Group. He had been manager of manufacturing operations for Hughes-Fullerton; had held positions at Hughes as manager of production engineering, Tucson, Ariz.; manager of laboratory services-guided missile; and chief of tool design and planning and production engineer at Culver City, Cal.



Stanley E. Casson, director of sales for the National Acme Co., has been elected vice president-sales for the company which he has served for 25 years. He was Detroit district sales manager for 23 years. Prior to joining National Acme, Casson was with Brown McLauren Mfg. Co., Detroit Screw Works and the automatic screw machine department of Ford Motor.

LAWRENCE M. THOMPSON has joined Manheim Mfg. and Belting Co., Manheim, Pa., as director of engineering. He will be responsible for quality control of all company products, product research and development, and plant engineering.

ARTHUR J. WELCH has been elected president and general manager of the Spring Div., Borg-Warner Corp. He succeeds HARRY P. TROENDLY who was advanced to chairman of the division's supervisory board. Welch has been associated with the division for 18 years.





Announcement has been made of the appointment of Don Greenberg, left, to the position of chief engineer at the Barnes Drill Co., Rockford, Ill. Greenberg was employed by the engineering department of the company in October of 1947. Prior to his recent appointment, he served as a sales engineer in the honing department.

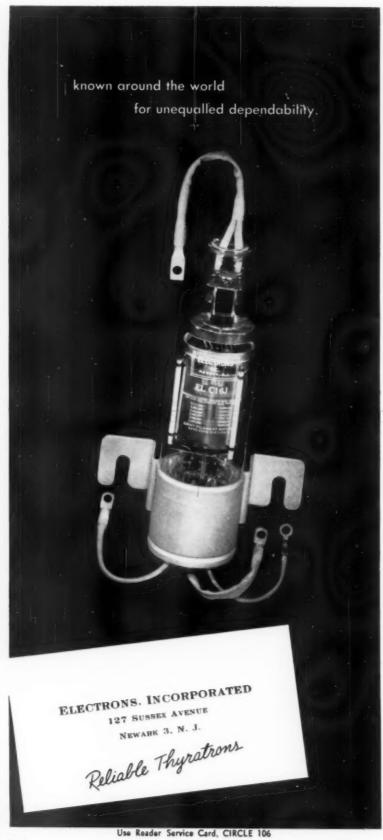
FRED W. ELLIOTT, JAMES A. DRAIN.
EMMETT H. MANN and B. CAMPBELL
BLAKE have been appointed group vice
presidents, each with designated divisional responsibility, at H. K. Porter
Co., Pittsburgh, Pa.

Announcement has been made of the appointment of Gordon Parrington as superintendent of the Dearborn, Mich., plant. American-Standard Industrial Div. He joined the division in 1956 as general foreman.



Henry M. Crossen, left, has been appointed director of manufacturing of the Clearing Div., U. S. Industries, Inc. He will be responsible for all manufacturing within the division. Prior to joining Clearing in 1959, Crossen was manager of plant and manufacturing engineering for the seven plants of the Stamping Div., Ford Motor Co.

The Tool Engineer





C. E. Hitch, right, has been named manufacturing manager at the F. Jos. Lamb Co., Detroit, Mich. He will be responsible for all manufacturing activities at both Lamb and its subsidiary, FabriTee. Hitch, who joined the company in 1936, has been shop superintendent since 1951. He is an experienced instructor in machine shop theory and metalworking principles.



Raymond J. Neely, right, has been appointed design engineer by the Hunter Spring Co., a Division of American Machine & Metals, Inc., Lansdale, Pa. He will be primarily concerned with the design and development of special inspection, testing and manufacturing equipment. Neely was formerly a testing equipment design engineer for the Tinius Olsen Testing Machine Co.

Firth Sterling Inc. has appointed Kenneth H. Carlson manager, technical services. He will serve as technical and metallurgical adviser to users of the company's products. Carlson was formerly with Latrobe Steel Co. and Jones & Laughlin Steel Corp.

CLARENCE J. COSGRO has been named general foreman of Arrow Tool Co., Wethersfield, Conn. He has held the position of metalworking foreman with Gilbert & Barker Mfg. Co., Fruehauf Trailer Co., and American Bosch Arma.





### Catching Up with a Slippery Equation

What goes on when two moving surfaces are separated by a film of oil?

Simple question? Maybe, but engineers and mathematicians have been trying to answer this classic question of lubrication ever since Osborne Reynolds neatly stated the problem in equation form back in 1886.

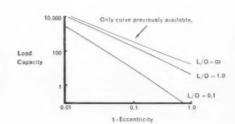
Unfortunately, analytical methods for solving Professor Reynolds' partial differential equation worked only for unrealistic oil bearings, bearings with widths approaching zero or infinity. And approximate methods were crude, requiring a complete recalculation for each slight change in the bearing.

Recently, mathematicians at the General Motors Research Laboratories came up with the most versatile and efficient method of solution yet made. Their analytical method for solving the two-dimensional Reynolds' equation applies to all finite journal bearings—as well as other hydrodynamic bearings—with no assumptions or approximations about boundary locations. The new method uses a long-neglected energy theorem recorded by Sir Horace Lamb instead of the force relationship tried by Reynolds and others.

Besides being a valuable contribution to the theory of lubrication, this work has its practical side: namely, accurate, serviceable design curves for engineers. At GM Research, we believe delving into both the theoretical and applied sides of a problem is important to progress. It is a way of research that helps General Motors fulfill its pledge of "more and better things for more people."

### General Motors Research Laboratories Warren, Michigan

Hydrodynamic analyses have led to specific answers about bearing operation. Shown here are the oil pressure distribution (main illustration) and load-carrying capacity for a non-rotating journal with a reciprocating load.



### Field Notes

General Electric Atomic Power Equipment Department (APED) has contracted to design and manufacture nuclear instrumentation for Atomic Energy Commission's Hallam Nuclear Power facility in Hallam, Neb. The contract was signed with Atomics International, a division of North American Aviation, Inc., which is supplying the nuclear portion of the 75,000-kw, sodium-graphite power station. Consumers Public Power District of Nebraska will operate the station after its completion in 1961.

#### expansions

Opening of a new plant in Expressway Industrial Park marks the fifth major expansion move for **MiLat Machine & Tool Co.**, formerly of Brooklyn. Occupying 15,000 sq ft on a 2½ acre site, the plant is designed to provide expansion up to 50,000 sq ft when future needs require.

Nelco Tool Co., a subsidiary of the Cutting Tool Div., Brown & Sharpe Mfg. Co. has expanded its manufacturing facilities in Manchester, Conn. Completed in early April. the addition is equal in size to the original Nelco Manchester plant.

Engineering and management personnel have occupied an additional 7600 sq ft of office space at the Pall Corp. main office and plant in Glen Cove, N. Y. Most of the new space is allocated to expansion of engineering facilities which will be more than doubled. Pall Corp. is a manufacturer of fine filters for removal of materials in the low micron ranges.

Union Carbide Chemicals Co. has awarded a construction contract to alter and revise plant facilities at Brownsville. Texas. to Brown and Root of Houston. Construction work is scheduled for completion early in 1961. The Brownsville plant will be Carbides eighth producing center for a line of more than 400 chemicals for industrial and consumer use.

#### new facilities

Air Reduction Pacific Co., a division of Air Reduction Co., Inc., has opened a new liquid air separation plant in Richmond, Calif. Including related distribution equipment, the installation was built at a cost of approximately \$3,000.000 and will produce 30 tons of liquid oxygen, nitrogen and argon per day.

Armour Alliance Industries, Alliance, Ohio, has announced opening of a newly constructed industrial adhesives plant at Philadelphia. Containing over 15,000 sq ft, the plant will service industrial adhesive customers throughout the Eastern United States. The Philadelphia plant is the third in a series of industrial adhesive plants built by Armour within the past year.

Naugatuck Chemical Div., United States Rubber Co., will construct a new technical center near its main plant in Naugatuck, Conn. Designed to broaden research and speed technical service for customers, the center will be completed in 1961.

A 14-acre tract of land in Solon, Ohis has been purchased to provide new manufacturing facilities for Master Power Corp., air tool subsidiary of The Austin Co. of Cleveland for construction of the facility. Providing 50,400 sq ft of manufacturing and office space, the factory and office building will cost approximately \$700,000.

Borg-Warner Corp. has formed a new division to be known as the Borg-Warner Controls Div. The new operation, located at Santa Ana, Calif., will take over personnel, products and existing facilities of the BJ Electronics plant of Borg-Warner Corp.

#### new companies

Formation of M-F Equipment Co. to handle sales of barrel-finishing equipment to dealers has been announced by Paul E. Kirchartz. president of Metal Finish. Inc.. Newark. N. J. The new organization will distribute "Vibraslide" vibrating-rotating machines. "Metal Finish" barrel-finishing machines as well as a complete line of separating and materials handling equipment.

Bowmar Instrument Corp., Fort Wayne, Ind., has established Bowmar Pacific, Inc., as a wholly owned West Coast subsidiary. Scheduled to begin manufacturing and research operations in March, the new division will service West Coast and Southwestern accounts for the parent firm. Bowmar is a producer of gearheads, servo-packages and precision counters for U. S. missiles and aircraft industries.

An Environmental Engineering Division offering services and products to companies in the electronics and missile fields has been organized by **Bethlehem Foundry and Machine Co.** in Bethlehem, Pa. Bethlehem Foundry presently serves the steel, cement, nuclear equipment and processing industries.

#### acquisitions

Electro-Mech Corp. of Norwood, N. J., manufacturers of control systems and associated control apparatus has been purchased by American Chain & Cable Co., Inc., New York. Products of Electro-Mech include graphic, pneumatic and electric control panels, console control centers, flexible annunciator systems and control transformers.

Remco Mfg. Co. producer of hydraulic and air cylinders has purchased the complete cylinder line of Turlock Iron & Machine Works. All production machinery, employees and management have been moved 200 miles to the Remco plant in Willits. Calif.

The A. O. Smith Foundry at Huntington Park, Calif., has been purchased by Ampco Metal, Inc. Ampco's present plant at Burbank, Calif. will be sold as part of the companies plans to expand in Huntington Park.

Kropp Forge Co. has acquired jobforging operations of Giant Grip Manufacturing Co., Oshkosh, Wis. Included in the acquisition are approximately 500 active steel forging dies.

#### association news

The Industrial Diamond Association of America, Inc., Pompton Plains, N. J. at its 15th Annual Meeting and Convention held at the Hollywood Beach Hotel, February 22 through 26, elected the following officers to serve for the coming year: as president, Bernard Jolis, U. S. Industrial Diamond Corp.; as first vice-president, Leopold H. Metz-



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#### Field Notes

ger, Super-Cut, Inc.; as second vicepresident, Charles V. Baumgold, Diamond Tool Research Co., Inc.

The convention opened Monday, Washington's birthday, February 22, with five committee meetings and the board of directors meeting, followed by the officer's reception and dinner. Tuesday morning, February 23, the membership met in general session and discussed and acted upon many activities of vital interest to the industrial diamond industry.

Fluid Power Society, a new technical society has been formed to further the development and use of fluid power. Membership in the society is on an individual basis but principal activities will be carried on through local chapters. First meeting of the Fluid Power Society was held in Detroit on April 21. Headquarters of the Society are at 5595 N. Hollywood Ave., Milwaukee 17, Wis.

Two new standards recommendations have been drafted by the Pulley and Belts Committee of the International Organization for Standardization. The standards establish diameters and tolerances of pulleys as well as shape and approximate dimensions of pulley crowns for flat transmission belts. Copies of the ISO recommendations are available at 60 cents each from the American Standards Association, Dept. PR 132, 10 E. 40th St., New York 16, N. Y.

New member-companies of The Material Handling Institute, Inc., are: Sundstrand Hydraulics, Div. of Sandstrand Corp., Rockford, Ill.; Minneapolis-Moline Co., Hopkins, Minn.; and Vac-U-Lift Co., Salem, Ill. Material Handling Institute is now composed of 89 member companies that manufacture all types of industrial material handling equipment and component parts, or offer related industry services.

#### awards

The DoAll Co. of Des Plaines, Ill., has won a George Washington Honor Medal Award presented annually by the Freedoms Foundation, Valley Forge, Pa. The award was made for the DoAll Co.'s educational exhibit, "The Dawn of This Age." housed in the Hall of Progress in the company's administration building.

Establishment of the Bradley Stoughton Student Award at Lehigh University through the gift of \$500 by the Lehigh Valley chapter of the American Society for Metals has been announced

#### Field Notes

by Elmer W. Glick, university treasurer. Income from the endowment is to provide an annual award to a top-ranking student in the department of metallurgy.

The award honors the late Dr. Bradley Stoughton who served as head of Lehigh's department of metallurgy from 1923 to 1944. A nationally prominent metallurgist, Dr. Stoughton was the inventor of a converter for making steel castings and of the process for oil melting in cupolas.

Announcement has been made by the Instrument Society of America of the establishment of an annual award to an ISA member making the most important technological contribution to the conception and implementation of a new principle of instrument design, development or application. Consisting of a citation and a cash award of \$1000, the newly announced annual award is to be known as the Arnold O. Beckman Award, named in honor of Dr. Arnold O. Beckman. of Altedena, Calif., former president of the Society, and one of its honorary members.

#### new activities

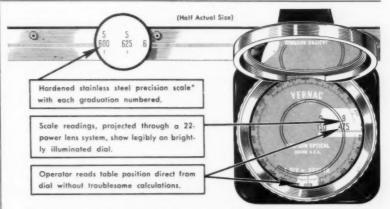
Appointment of Mills & Lupton Supply Co., 749 E. 12th St., Chattanooga, Tenn., as a distributor for Crown compressed air system components has been announced by D. A. Cameron, general sales manager-distributors, Parker-Hannifin Corp. The Crown products—including air pressure regulators, air filters and lubricators—are made by the corporation's Hannifin Co. division in Des Plaines, Ill.

Lehigh University has received a grant of \$21,670 from the National Science Foundation for support of the development of educational aids for mechanical engineering. General objective of the project is to contribute to strengthening of curricula in mechanical engineering through development of teaching and learning aids for laboratory instruction and courses in design.

Lear, Inc. has received \$2,250,000 in additional funding on the Army's Nike-Zeus antimissile missile from Bell Telephone Laboratories, Inc. With this new funding, Lear's Instrument Div. at Grand Rapids, Mich., will continue working on the missile's gyroscopic control instruments. This brings to \$9.3 million the total awards to Lear in the Nike-Zeus program since its original contract from Bell in March 1957.

Charles B. Quarnstrom, president, Coated Abrasives, Inc., announced that transfer of manufacturing and headquarters operations from Milwaukee, Wis. to the Detroit Metropolitan area has been completed. The company manufactures a full line of abrasive specialty items and engages in coated-abrasive application research. It holds a number of basic patents on products extensively used in the aircraft and allied industries. The company's new manufacturing plant is located in Warren, Mich. General staff offices are at 11920 E. Eight Mile Rd., Detroit.

Minneapolis-Honeywell Regulator Co. has embarked on a program designed to expand its activities in the field of electronic medicine. Company specialists assigned to the newly formed medical instrumentation group will take over work now underway in three Honeywell divisions. In addition to its engineering responsibilities, the new group will take over marketing of all equipment Honeywell now supplies to the medical field, including body-function recorders, magnetic tape recorders, medical oscillographs and other especially designed systems.



New optical measuring instrument assures . . .

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The new Vernac Direct Reading Optical Measuring Instrument eliminates the complexities of using end rods and gage blocks. Now, the longitudinal, lateral or vertical positioning of machine tool tables can be quickly and easily read direct to .0001". Accuracy is not affected by the wear or stretch of table movement screws. The instrument itself has no moving parts which can impair accuracy.

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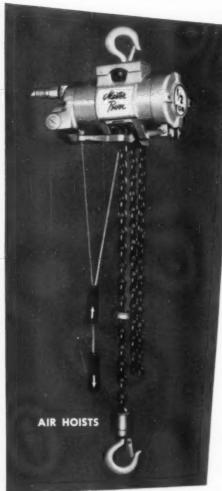


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Plastics Engineering Handbook, 3rd Edition—Edited by Alan F. Randolph. Published for The Society of the Plastics Industry, Inc., by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price \$15.565 pages.

Expanded and revised, this edition contains basic information about plastics materials, methods and fabrication. Each general method of fabricating plastics products is discussed with respect to principles, techniques and equipment. Covered in the various chapters are compression molding, transfer molding, injection molding, cold molding, extrusion, sheet fabrication, reinforced plastics, cellular plastics, casting, dispersions.

Of most interest to tool engineers are the nineteenth through the twentyfourth chapters which comprise about 40 percent of the book. A chapter on design standards for inserts describes construction and anchorage of inserts in plastics parts. An extensive chapter on design of molds and dies covers design considerations, materials, heat treating and finishing of molds. This chapter is abundantly illustrated. Remaining chapters treat: machining, finishing and decorating; cementing. welding and assembly; plastics as adhesives; and performance testing of plastics parts. Since the book is fairly comprehensive, it suffers only somewhat from lack of adequate reference

Nondestructive Testing Handbook—Edited by Robert C. McMaster, Published by The Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price \$24 for two-volume set. 1910 pages.

Prepared under the auspices of the Society for Nondestructive Testing, this handbook presents a comprehensive and authoritative treatment of all major methods of nondestructive testing. The book describes the fundamental principles and policies of nondestructive testing, the evaluation of tests for specific applications, detailed analysis of

basic test methods, and the sound interpretation of test indications. Description of each testing method proceeds logically from discussion of physical and chemical principles and associated mathematics through various test techniques to typical applications. Test selection charts are provided to furnish guidance on the best testing methods for given types of materials and defects.

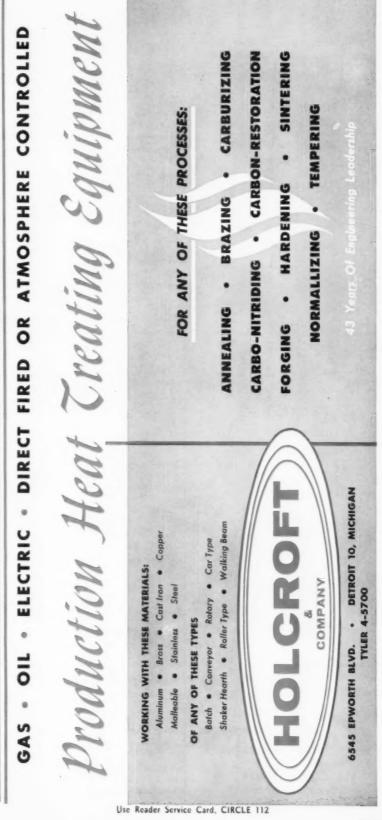
Organized in 54 sections, the book is profusely illustrated with charts, drawings, forms and photographs. Chapters include: management and application of tests, field and maintenance tests, liquid-penetrant testing, visual inspection tests, radiation and particle physics, radiation detection and recording, electrified-particle tests, magnetic-particle tests, magnetic field tests, eddy current tests, ultrasonic testing principles, natural frequency vibration tests, brittle-coating tests, photoelastic-coating tests and resistance strain-gage tests. Typical of the many applications discussed are: heat-cracks in forgings. fatigue cracks, machining marks, extrusion defects, metal thickness gaging, coating thickness gaging, honeycomb structures, weld defects, grinding eracks, soft spots in alloys, and iron impurities in nonmagnetic materials, Bibliographies follow each chapter.

Guide to the Space Age—By C. W. and Hazel C. Besserer. Published by Prentice-Hall. Inc., 70 Fifth Ave., New York 11, N. Y. Price \$7.95.

More than 5,000 terms peculiar to the space age are alphabetized and cross-referenced in this compendium. From Angstrom to Zuni, the definitions are clear and comprehensible, and include colorful vernacular expressions such as "fizz pot" and "go juice" as well as technical definitions.

Industrial Packaging—By Walter F. Friedman and Jerome J. Kipnees. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price \$11.50, 536 pages.

This work offering an up-to-date survey of the packaging materials, methods and equipment, is organized into three main parts. The first part introduces the packaging field and includes the historical evolution of packaging. The second part covers packaging materials and containers and discusses the most important media used to contain and protect products in distribution. The third section deals with packaging methods and equipment and includes the integrated aspects of packing and packaging.



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### who's meeting

May 1-5. THE ELECTROCHEMICAL SO-CIETY. General technical sessions and symposia, 117th meeting, LaSalle Hotel, Chicago, Ill.

May 4-14. U. S. WORLD TRADE FAIR, Coliseum, New York, N. Y.

May 9. Investment Casting Institute. One-day clinic, Essex House Hotel, Newark, N. J.

May 9-11. INSTRUMENT SOCIETY OF AMERICA, Third National Power Instrumentation Symposium, San Francisco, Calif.

May 9-13. American Foundrymen's Society. 1960 Castings Congress and Exposition, Convention Hall, Philadelphia, Pa.

May 9-13. AMERICAN SOCIETY FOR METALS. Second Southwestern Metal Exposition and Congress, Texas State Fair Park and Sheraton-Dallas Hotel, Dallas, Tex.

May 11-13. AMERICAN MATERIAL HAN-DLING SOCIETY, Los Angeles Chapter. Third Western Regional Material Handling Show and Packaging Cavalcade. Great Western Exhibit Center, Los Angeles. Calif.

May 11-14. THE FLUID CONTROLS IN-STITUTE, INC. 1960 Spring meeting, The Greenbrier, White Sulphur Springs, West Va.

May 17-19. ASME. Production engineering conference, Milwaukee, Wis.

May 22-26. ASME. The 32nd Oil and Gas Power Conference, Kansas City, Mo.

May 23-26. Design Engineering Show, Coliseum, New York, N. Y.

May 23-26. ASME MACHINE DESIGN DIV. Design Engineering Conference, Coliseum, New York, N. Y.

May 24-26. AMERICAN SOCIETY FOR QUALITY CONTROL. 1960 Convention, San Francisco, Calif.



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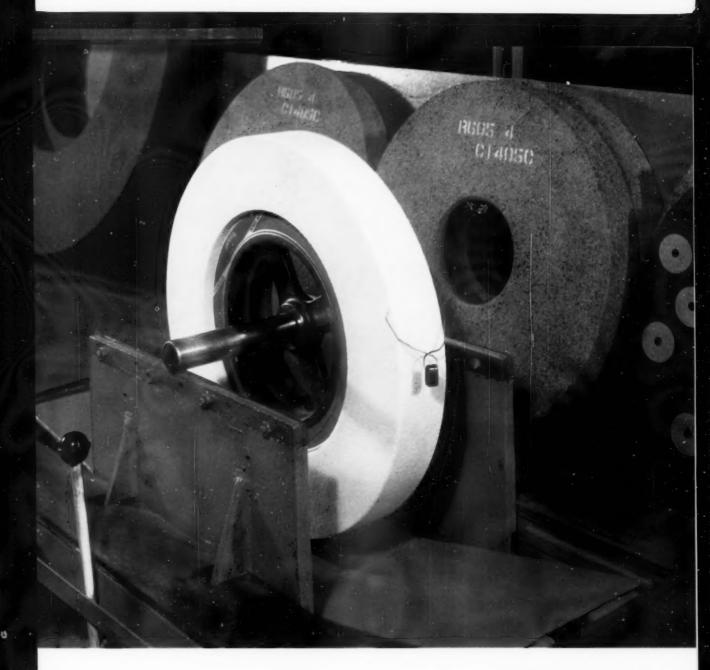
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### SHOP TESTS PROVE SUPERIORITY

This photo shows the second of two high speed steel routers failing to cut copper clad Fiberglas printed circuit board. Note the burning of tool and material and the jagged hole at left in test work piece.

The new Atrax Router plunged and cut at 20,000 rpm leaving clean slot shown at right.

#### COMPARISON OF TEST TOOLS



Two high speed routers on left were unserviceable after a few seconds. Atrax Solid Carbide Router showed no wear land and left clean slot with no bur on either side of printed circuit board.

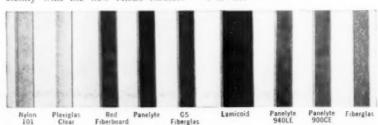
# NEW ATRAX STUB ROUTER PLUNGES, SLOTS, FORMS EXTREMELY HARD-TO-CUT MATERIALS





#### ADDITIONAL TESTS ON OTHER TOUGH MATERIALS

Nine other materials commonly used in printed circuit board work were tested. All were cut quickly and efficiently with the new Atrax Router. These materials can also be drilled readily with the new Atrax Micro-Drills available in wire sizes from #1 to #80.



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### Effective Depreciation Legislation



By Joel Barlow

Chairman Committee on Taxation Chamber of Commerce of the United States of America

The National Chamber must oppose the Administration proposal and H.R. 10491 and 10492 unless they are coupled with legislation or a definitive and fully implemented Treasury program for a more realistic depreciation policy and practice with respect to depreciable lives and salvage adjustments.

The pattern of the Treasury's efforts in the past few years suggests that it is wishful thinking to assume that the agents in the field will change their approach without a rewrite of the regulations and the elimination of Bulletin F either administratively or through legislation.

We must have in mind, also, that as a reason for not instituting depreciation reform at the administrative level in the past, officials in the Treasury have said that reform can come about only through legislation. They have argued that since Congress has many times enacted legislation against the background of the pattern of Bulletin F and TD 4422, this pattern cannot be changed without action by Congress. Certainly Congress is also entitled to know how far the Treasury now thinks it can implement any reform it may have in mind without legislation, and what additional legislation if any the Treasury thinks will be needed.

The panel discussions on depreciation made it abundantly clear that limiting the capital gains treatment of depreciable personal property is only one facet of the larger depreciation question and it can only be justified as a quid pro quo for a major change in existing depreciation law. The panel discussions also made it clear that any change must make certain that obsolescence is

fully recognized in shorter depreciable lives with a minimum of salvage or residual value.

Nearly everyone recognizes, including the Treasury that we have to get rid of our outmoded depreciation and replacement practices in this country if we are going to modernize our plants and reduce our costs so as to compete effectively with our foreign competitors for the markets of the world and even our own domestic market.

This has been stated time and again by political leaders of both parties and it is implicit in the recent recommendation of the President and the Treasury. But to conclude that a simple change in Section 1231 capital gains treatment, followed by more surveys, studies and possible future legislative recommendations will accomplish this or give depreciation reform any real momentum is to ignore the Treasury's own experience in the past few years as well as that of all the other leading industrial nations of the world.

Section 1231 can be one element in a controversy, and often is, but it is not the basic cause. The principal difficulty is the improper physical-life yardstick of Bulletin F and the absence of any self-executing formula (such as other nations have) or even guidelines for determining obsolescence. Obsolescence cannot be proved but only prophesied, and changing Section 1231 treatment will not perceptibly minimize the continuing controversy or solve what is really a basic legislative problem.

To solve this basic problem and bring the necessary certainty and equity into the law, the National Chamber has recommended adoption of the "bracket method" which is similar to the system of depreciation that has been so effectively used in Canada since 1949. The Chamber also favors elimination of the present \$10,000 limit on the additional first-year depreciation allowance, as another way (following the English system) to bring realism and fairness into our depreciation structure.

There is some question whether a restrictive legislative proposal will not further complicate the depreciation problem. It will hinder modernization because it will discourage the disposition and replacement of depreciable productive assets. One of the initial reasons for creating a special capital gains classification and rate was to reduce the braking effect of income taxes on the turnover of capital assets. With an obsolescence factor of nearly 50 percent in our national industrial plant it is almost tragic to add another deterrent to the acquisition and replacement of productive facilities.

Serious inequities will also result, in several ways, from the proposed restrictions of capital gains treatment. First, gain from the sale of capital and depreciable assets represents an accretion of dollar value that has taken place over a long period of time. In the case of individuals, partnerships and small corporations, this income bunching is, of course, inequitable. What sole proprietorship or partnership will sell a piece of equipment if the gain (which may be largely inflationary) takes taxable income from the 50 percent or 60 percent bracket to the 80 percent or 90 percent bracket? Because it particularly penalizes the individual through the steeply progressive rates, it will penalize most often the small businessman doing business individually or as a small corporation.

Capital gains treatment has evolved as the product of an experience and logic which have shown that such treatment is necessary in our present tax system to provide equity and prevent a dampening effect on our economy and tax revenues. This treatment should not be restricted unless or until the adverse effects this will cause are fully compensated by an over-all reform of the depreciation system. Further, it should not be restricted unless the restriction is necessary to make the particular reform that is adopted workable.

Unless reform is to take place, and the kind of reform that makes a change in capital gains treatment desirable to prevent abuse, it is clear that the present proposal is unnecessary and in fact harmful.

The Chamber makes the following specific recommendations.

 Instead of this backdoor approach to depreciation reform the Treasury should recommend an over-all revision of our tax depreciation system that will

MAKE ALL

give full recognition to the factor of obsolescence, eliminate needless controversies over depreciable lives and salvage value, encourage taxpayers to use shorter and more realistic depreciable lives, and give us a dynamic system comparable to our international competitors. The discredited historical physical-life concept and Bulletin F approach should be abandoned.

The present proposal limited to capital gains can only be justified if it is coupled with an over-all revision that is broad enough to make a restriction on capital gains necessary so as to prevent abuse.

3. The bracket depreciation method with greatly shortened useful lives following the pattern of the Canadian class-rate system should be adopted. The Chamber also favors the elimination of the \$10,000 limitation in Section 179 and urges the immediate adoption of this simple amendment if the Treasury's proposal is to be accepted.

4. In the event that the Treasury and this Committee feel that adequate depreciation reform can be accomplished administratively, the specific program to be adopted should be fully formulated before the present proposal is considered further. Then, if it appears that the Treasury's new proposal is feasible, this Committee should make certain that the legislative history covering any restriction of capital gains treatment specifies the kind of reform that must occur, and that it is the intention and understanding of Congress that such reform can and will be accomplished administratively within the framework of existing legislation.

5. If the restrictive treatment of H.R. 10491 and H.R. 10492 is to be adopted as a preliminary to other depreciation legislation, then it should be limited temporarily to tangible personal property having a depreciable life of five years or less to prevent the taxation of phantom profits.

Based on testimony on Depreciable Personal Property presented to the House Ways and Means Committee by Joel Barlow, Chairman, Committee on Taxation, Chamber of Commerce of the United States of America.

#### The Importance of Design in Development of Industrial Equipment

Fresh design thinking can often cut production costs by simplifying the job of production. Form simplification can cut complexity and thereby production time. The old gag that the ambition of an engineer is to design a part that cannot possibly be made is too often true. The industrial designer, who is primarily form conscious, can do a great deal in remodeling such parts so that manufacturing becomes much easier and less costly. As a matter of fact, we find that the industrial designer not only improves appearance and operator facility, but also reduces the cost of the product.

Industrial equipment may actually require higher standards of industrial design than do consumer products. Cars and appliances may try to use superficial "styling" to convince the public that the product is "improved," but purchasers of industrial equipment demand more. First, and most important, they measure the quality of the design by their own profits. Industrial equipment cannot just look better, but must perform better. It must be more convenient to operate; must be more comfortable; must be safer; must be easier to maintain; must cost less or earn more, and what good looks it has must express inherent functional quality. Industrial design, therefore, in order to pay off must add to all of these qualities.



Based on a talk by M. S. Curtis, The Warner & Swasey Co., presented at an annual meeting of the American Society of Industrial Designers, 15 E. 48th St., New York 17, N. Y.



#### Machine Lubrication

Developments in tool engineering and machine tool design require that designers and manufacturing engineers become more familiar with the lubrication of machine tools and with the scientific basis of lubrication.

F. Kunowski has made a special study of the problems involved and has published his results in *Technisches Zentralblatt juer praktische Metallbearbeitung*, Vol. 35, No. 6, p. 195 to 204, under the title "Schmierung und Schmierstoffe fuer Werkzeug-Maschinen."

The author considers first—in a short survey—the latest developments in the theory of lubrication and the requirements for an adequate lubricant. Lubrication of plain bearings, antifriction bearings, gear trains and electrical disk clutches is covered. The stick-slip process is investigated in conjunction with the lubrication of guide ways on machine tools. Hydraulic oils are likewise taken into consideration, including the physical and chemical properties of mineral oils that the designer needs to know for developing hydraulic devices.

Antifriction bearings do not require as much lubrication servicing as plain bearings, although the quality of the lubricant for antifriction bearings is more important than in the case of plain bearings. This is due to the fact that considerable pressures are developed under load, resulting in deformation of the contacting bodies and causing a sliding motion in addition to the rotary motion. Lubricant composition is discussed.

The author has also investigated the stick-slip motion of parts gliding on guide ways and shows diagrams for the self-induced vibration resulting from variation in the coefficient of friction. The guide ways were lapped and the surface finish measured with an interference microscope in order to obtain

a reliable comparison between various lubricants, which differed only in the type and amount of polar additives. A special guide-way oil, identified only as Oil D, was developed to eliminate the "stick-slip" condition and the frictional vibration resulting therefrom.

#### **Turning Ductile Metals**

Chip breakers or deflectors are used in the turning of ductile and smearing metals such as aluminum, copper and low-carbon steel in order to prevent formation of a built-up edge on the tool face. H. Staudinger and W. Webser have run tests to investigate the various conditions to be taken into consideration in the determination of the proper dimensions of chip breakers and have published their results in Aluminium, Vol. 35, No. 9, p. 527 to 531 under the title: "Spanstufen-Gestaltung und Aufbau-Schneiden."

The tests were limited to the turning of aluminum (cast alloy containing approximately 12 percent silicon, German Standard G-ALSil2) using carbide tools (German Standard G-1—94 percent tungsten carbide, 6 percent cobalt). Chip deflectors were made of the same material. The true rake of the tool was 30 deg, the clearance angle 6 deg. Feeds were varied between 0.004 to 0.040 ipr, cutting speeds were from 660 to 1320 fpm. Chip breaker widths were 0.040 to 0.240 inch. Depth of cut was held constant at 0.12 inch.

Diagrams published with the article indicate the best condition for the chip breaker in relation to the feed and speed. As an example, it was found that a chip breaker of 0.160-inch width resulted in the best chip formation when cutting speed was 1320 fpm and feed was 0.012 ipr.

The required width of the chip breaker increases with increasing feed up to a feed of 0.024 ipr. Larger chip breakers are not recommended beyond this feed limit. Multipliers for determination of the chip-breaker width are given. The authors found that a variation of the angle of the chip breaker does not affect the chip formation. They suggest the use of special carbide tips with large true rake angles for the machining of aluminum in order to eliminate expensive grinding of the tips. The strength of cutting edge must likewise be taken into consideration.

#### **Engineer's Dictionary**

A special dictionary for engineers working in the field of tooling, manufacturing, metallurgy and related categories was recently published in a seventh edition. It is written for German engineers interested in English terminology although it can also be

used by English-speaking engineers who want to find an equivalent German term. The 500-page book is edited by H. G. Freeman and published by Verlag W. Giradet-Essen, West Germany, under the title Das englische Fachwort.

The largest section of the dictionary is devoted to special topics, such as "Deutsche und englische Einteilung der Eisen-und Stahlsorten," written in German and explaining the differences between gray cast iron and chilled cast iron and numerous other cast iron specifications and steels.

There are about 100 such chapters, each covering three to four pages, making use of double or multiple possibilities to translate German or English words. The value of the book would be greatly enhanced for American tool engineers if these 100 chapters were written in English.

The last 150 pages contain the German-English and English-German dictionary. This writer would not agree with a great number of translations, as indicated by the following examples: "Bearbeitungskosten" is translated as "tooling cost." It should be "machining cost." "Dehnung" is not "stress," as indicated in the dictionary, but "strain." "Kaltreckung" should be translated by "strain hardening." not "cold strain-ing." The German term "Schaltbewegung" is not limited to "feed motion." but also covers "shifting." In the English-German section the term "dayturn" is used for "Tagesschicht." although we would say "day-shift." Other terms are missing entirely, such as the German equivalent for "jogging"

The great majority of the translations are acceptable and with the reservations mentioned above in mind the dictionary will be useful.

#### **Automatic Grinding Machine**

An automatic internal and external grinding machine is discussed in the French magazine Machine outil Français, Vol. 24 (147), 1959, p. 131 ff. under the title: "Machine á rectifier ecycle automatiqué les faces intérieures et extérieures des pieces cylindriques."

When one work head has reached the end of a cycle, the next one automatically moves into position. The work-piece can be set up by hand or mechanically. The truing device is located between the two workheads and can be operated automatically either after each cycle or after a preselected number of cycles. It is claimed that very fine tolerances can be obtained with the least possible amount of handling time. The work cycle covers four movements: rapid infeed, rough plunge cut, fine plunge cut and finishing.

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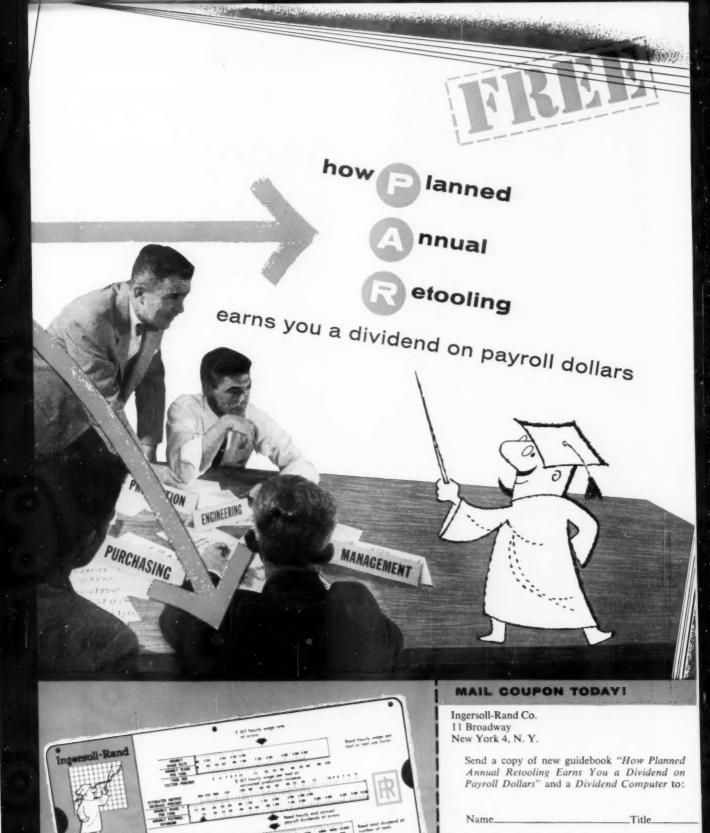
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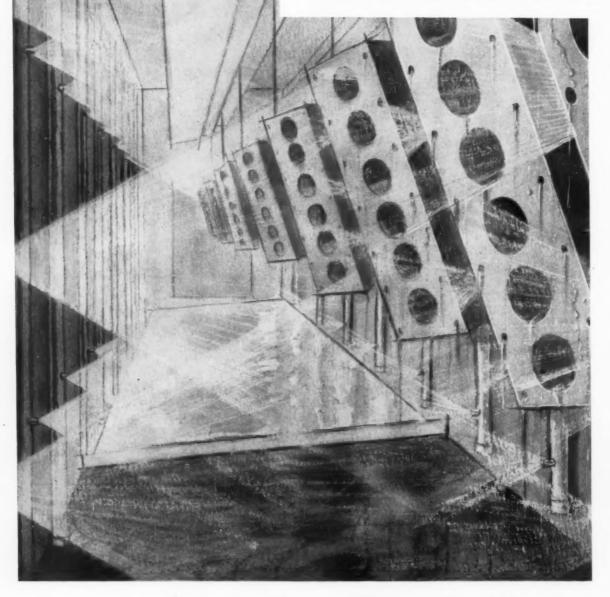
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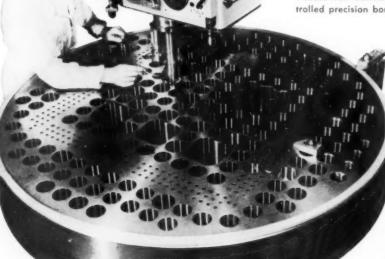
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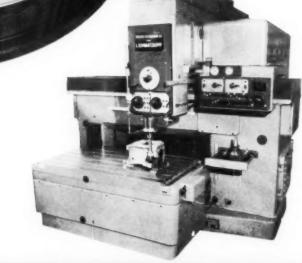
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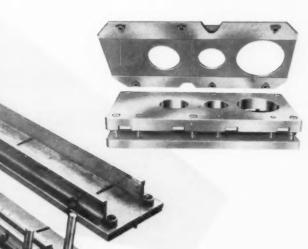
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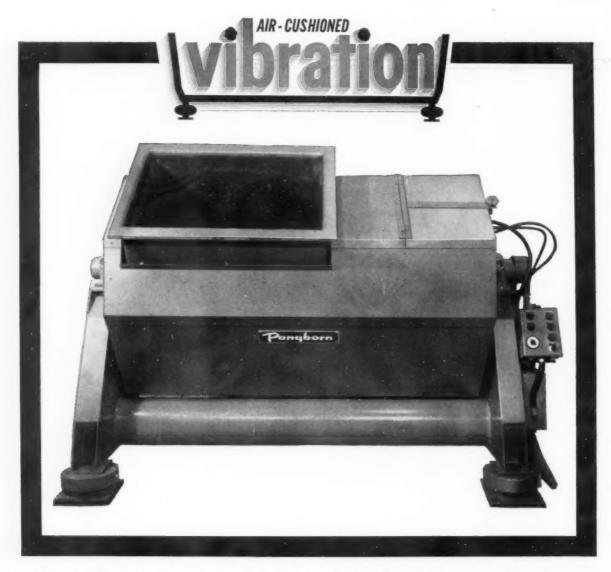


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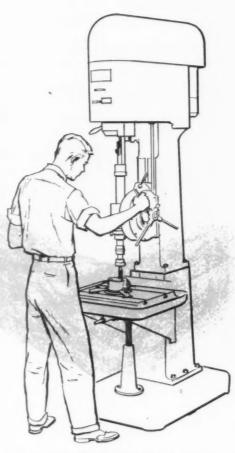
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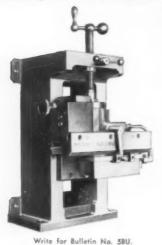
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for Bulletin No. 54,

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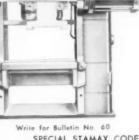


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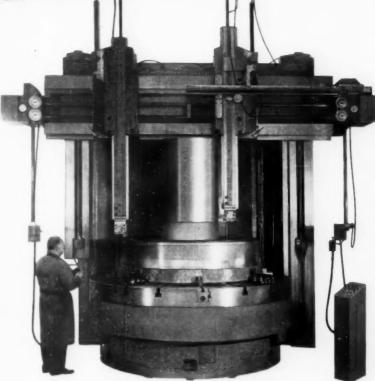
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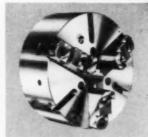
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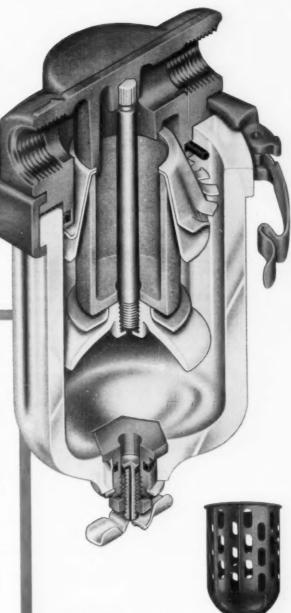
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Center columns are used on most indexing machines for large work or many operations. But for some of these setups we can use this new machine with a 40-inch index table that costs less than machines with center columns.

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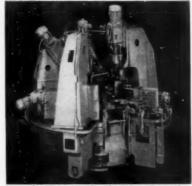
The machine shown here operates on aluminum cylinder heads. The work is tipped in each fixture so that the vertical units on columns operate on the two holes A. Behind the left column is a milling unit for the intake manifold face B. The operating unit is mounted

horizontally 45° left of the radial center line through the station, and the milling head is 17° off the vertical.

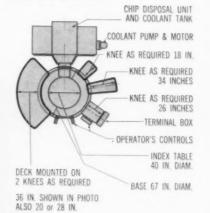
At the back of the machine are two units that work downhill at a 53° angle on hole D. Below them are two units that operate uphill at a 17° angle on two holes C. Finally at the right are two horizontal units for hole E, each mounted 45° left of the radial center line.

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Every machine has good basic design and accurate rugged construction. These machines pay off by operating with minimum trouble for years. If you have a job for a multi-unit automatic, we want to talk specifics with you. How about it? Kingsbury Machine Tool Corp., Keene, New Hampshire.



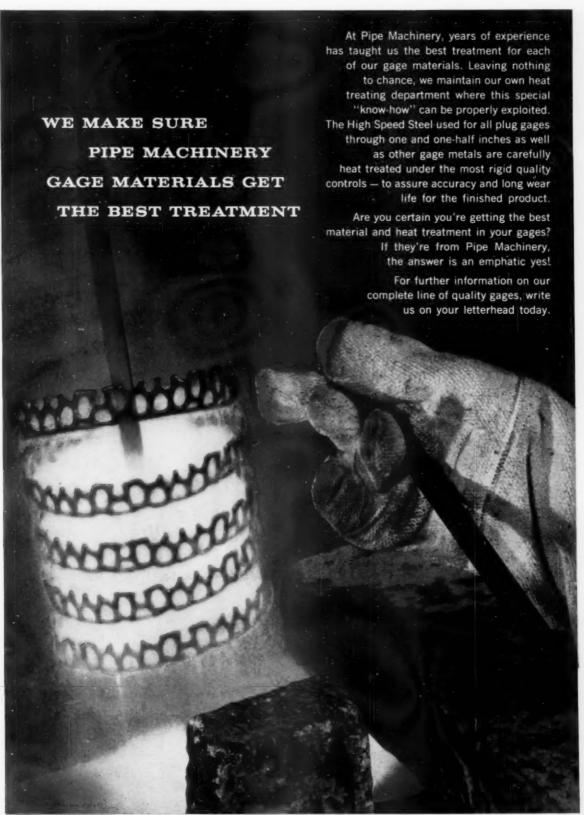
Base is 67 inches in diameter. Operating units are mounted on knees 18, 26 or 34 inches deep as needed, or on decks that in turn are mounted on two knees per deck. Index drive unit is inside base and has a 1 HP 1750 RPM motor.



(Below) Nine units operate from five directions at gross rate of 150 parts per hour. Index table holds five work fixtures with power clamping and unclamping.







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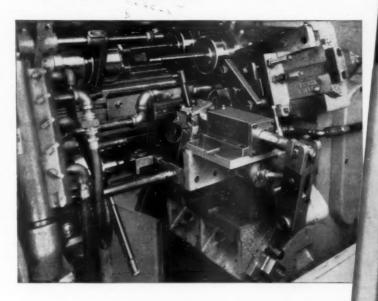
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3/4-16 thread is cut in 3rd position, 3/4-10 in 4th. Piece is rotated end-for-end by transfer attachment.



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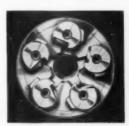
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The Tool Engineer





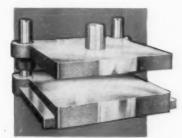
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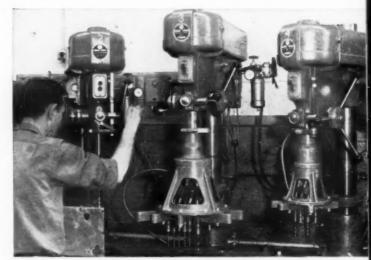
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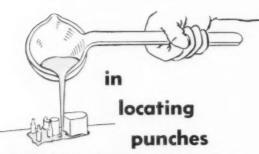
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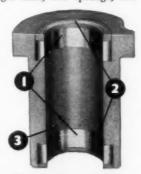
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Mfg. Engineers	F
*American Twist Drill Co., Subsidiary	* Fellows Gear Shaper Co
Cutting Tool Division,	G
Brown & Sharpe Mfg. Co	
*&Ames Co., B. C	Gaertner Scientific Corp
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Perry Equipment & Eng. Division	*Gulf Oil Corp
B	
Baird Machine Co	H
Barber-Colman Co	*Mannifin Co., Division
Barnes Drill Co	Parker-Hannifin Corp
•Bath & Co., John	*Harig Mfg. Corp 35
Bay State Tap & Die Co	Hardinge Brothers, Inc
Beaver Pipe Tools, Inc	*Hartford Special Machinery Co
Behr-Manning Co	Heald Machine Co., Subsidiary
Bethlehem Steel Corp 6	Cincinnati Milling Machine Co Inside Front Cover
Black & Decker Corp.	Hoggson & Pettis Mfg. Co
Master Power Corp., Subsidiary	Holcroft & Co
Blanchard Machine Co., The	Hutchinson Co., Wm. T
Bloom Machinery, John I	1
Borg-Warner Corp.,	*Industrial Diamond Division,
Rockford Clutch Division	Engelhard Hanovia, Inc
Boston Gear Works	*Ingersoll Milling Machine Co., The
Brookfield, Inc	Cutter Division 42
*ABrown & Sharpe Mfg Co 171	*&Ingersoll-Rand Co
*&Brown & Sharpe Mfg. Co.,	1
Cutting Tools Division,	
American Twist Drill Co., Subsidiary 169	Jacobs Mfg. Co
Bryant Chucking Grinder Co	Jahn Mfg. Co., The B
♦Bullard Co., The	*Jarvis Corp
Butterfield Division 76	Jergens Tool Specialty Co
C	
*Cadillac Stamp Co	K
Capewell Mfg. Co	*&Kennametal, Inc 200
*&Carr-Lane Mfg. Co	Kingsbury Machine Tool Corp
**Cerro de Pasco Sales Corp	King Tester Corp 214
Chicago-Latrobe 11	*Kuzmick Co., The Paul L
Chromalloy Corp., Sintercast Division	I.
Cincinnati Milling Machine Co.,	*&Lapeer Mfg. Co
Heald Machinery Co., Subsidiary Inside Front Cover	LaPointe Machine Tool Co., Division
Columbia Tool Steel Co	General Purpose Machine Corp
*Cosa Corp 66	* Latrobe Steel Co
*Cutler-Hammer Co.,	*Leland-Gifford Co
Airborne Instruments Laboratory,	Lindberg Engineering Co
Division	*&Littell Machine Co., F. J
Cutter Division,	*&Livernois Engineering Co
The Ingersoll Milling Machine Co	*Logansport Machine Co
Crobalt, Inc	*Lufkin Rule Co
P	M
*Danly Machine Specialties, Inc 69	Machine Tool Builders Assoc
Dayton Rogers Mfg. Co	Manhattan Rubber Division,
Delta Power Tool Division,	Raybestos-Manhattan, Inc 59
Rockwell Mfg. Co	*Marac Machinery Co
**Detroit Stamping Co	Marshall Steel Co
**Devcon Corp 10	*Master Power Corp., Subsidiary,
Dixie Tool Industries	Black & Decker Corp
**DoALL Co., The	Marvel Tool & Machine Co
Day Chart 1 Co. mi	
Dow Chemical Co., The	Mayline Co
Dow Chemical Co., The	Mayline Co
*Dumore Co., The 40  *Dumore Co., The 29  Dykem Co., The 248	Mayline Co.         251           McCrosky Tool Corp.         206           Merit Products         182

Meyers Co., W. F	Simpson Optical Mfg. Co
*Moore Special Tool Co	Sinclair Refining Co
Morris Co., Robt. E	Sintercast Division.
Morse Twist Drill & Machine Co., Subs.,	Chromalloy Corp
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N	
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*Norgren Co., C. A	Stocker & Yale, Inc
North Electric Co	Sturtevant Co., P. A
Norton Co.,	<b>♦</b> Sun Oil Co
Behr-Manning Co., Div 67	Sundstrand Machine Tool Division,
Norton Co.,	Sundstrand Corp70-71
Machine Division	* Superior Steel Products Corp 241
O ·	T
° &O. K. Tool Co., Inc., The	Thompson Grinder Co
Oahite Products, Inc	Thompson & Son Co., The Henry G
*Ortman-Miller Machine Co	*Thor Power Tool Co
P	*Threadwell Tap & Die Co
	*Thriftmaster Products Corp. 63
*Pangborn Corp., Vibrator	
Finishing Division 224	Titan Tool Co
Parker Fittings & Hose Division,	U
Parker-Hannifin Corp 221	*Union Mfg. Co
*&Parker-Hannifin Corp.,	Unimet Carbides Corp 15
Hannifin Co., Division	♦United Greenfield Corp 181
Pekay Abrasives, Inc	*Valvair Corp
Penninsular Grinding Wheel Cor	*Valvair Corn 68
*&Perry Equipment & Engineering Co.,	Van Norman Industries, Inc.,
Division Automation Devices, Inc	Morse Twist Drill & Machine Co
♦Pipe Machinery Co	Subsidiary
Pope Machinery Corp	*Vassoloy-Ramet Corp
Pratt & Whitney Co., Inc	Vee-Arc Corp. 206
* Producto Machine Co., The	Verson AllSteel Press Co
R	Vibratory Finishing Division,
Raybestos-Manhattan, Inc.,	
Manhattan Rubber Division 59	Pangborn Corp
Ring Punch & Die, Inc	*Vlier Engineering, Inc
Rivett, Inc	W
Rockford Clutch Division,	*Walker-Turner Division,
Borg-Warner Corp	Rockwell Mfg. Co
*Rockwell Mfg. Co.,	Wallace Supplies Mfg. Co
Delta Power Tool Division	*Weldon Tool Co., Inc
Rockwell Mfg. Co.,	♦Wesson Co
Walker-Turner Division 242	*Wheel Trueing Co
♦Russell, Holbrook & Henderson, Inc. 220	Whitman & Barnes, Inc
• russen, Holorook & Henderson, Inc	♦Wiedemann Machine Co 26
#4Cohour Truming Inc	Woodruff & Stokes, Inc
* Scherr-Tumico, Inc	Woodson Tool Co
*Schrader's Son, A	V
*&Scully-Jones & Co	Vader Co The
* Service Machine Co	Yoder Co., The
Service Research & Development Co., Inc	Z
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# LOOKING AHEAD

By T.W. Black Senior Associate Editor

Tool and manufacturing engineers are keeping their eyes on the computer control of complex industrial processes. Use of computers that have decision-making abilities is already being considered in the chemical industries and the computer control of mass production lines in the metalworking industry is a definite future possibility.

An example of automatic control that utilizes a simple computer is furnished by two fully automatic data-gathering and processing systems developed by Baldwin-Lima-Hamilton for a manufacturer of heavy steel pipe.

The machine measures the length and weight of each pipe and stencils these variable data on the individual pipe. In addition it computes the weight per foot of each pipe, rejects out-of-weight tolerance pipes, indicates and prints the cumulative number of pipes, the individual and cumulative total lengths and weights, the time, the date, and certain preset records.

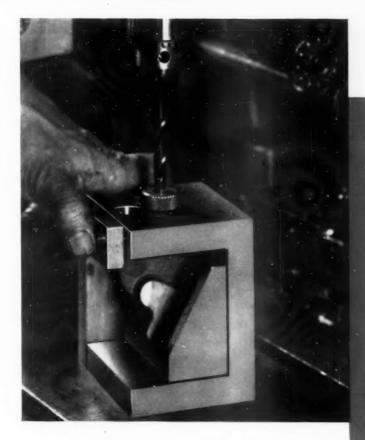
As pointed out by Carl E. Stugard in this issue, computers are already extending automation to engineering departments. Some companies today are using computers to design parts. The same computer can be used to automatically produce a control tape for automatically machining the parts it has designed. No blueprints or shop drawings are needed.

Vibratory barrel finishing is showing outstanding results in many plants. Shakespeare Corp., Kalamazoo, Mich. manufacturer of fishing tackle, reports that deburring a stainless steel part, which took 48 hours in a conventional barrel, is accomplished in five hours in a vibratory barrel. Burnishing time on the same part has been cut from seven hours to 1½ hours. Roto-finish barrels are used.

Development and commercial availability of a man-made diamond for metal-bonded grinding wheels has been announced by General Electric's Metallurgical Products Dept. Typical particles of the new diamond are of single-crystal and blocky shape, with many showing regular crystal faces. Previously produced man-made diamonds were in needle and plate shapes, which are best for vitrified and resinoid bonded wheels.

Budd Co. has developed a new process for making forming dies and foundry patterns. In this process, nickel carbonyl gas and carbon dioxide are passed over a heated tin-alloy mold. Pure nickel is deposited on the mold.

The deposited nickel shell can be built up to any desired thickness. When it is removed from the mold it is backed up by filled epoxy resin. Surface finished and tolerances are excellent and no machining is required. This cuts lead time and costs. Budd is currently marketing dies and patterns made by the new process.



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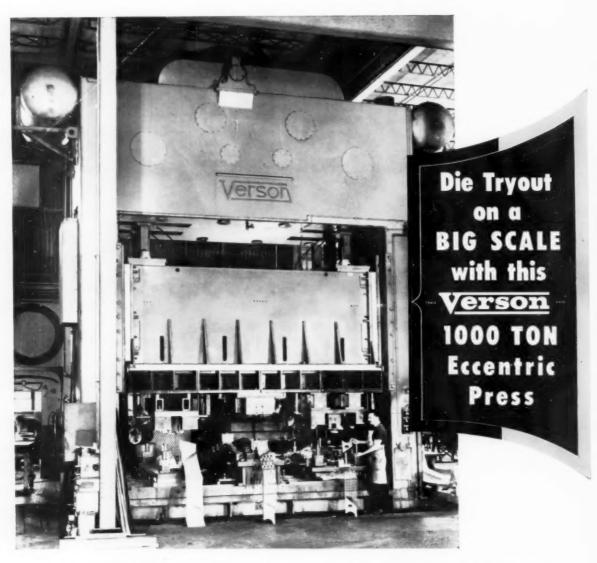


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Efficient Tool and Die Company, Cleveland, Ohio, has big problems . . . big in the sense of physical size. As die makers for the automotive, appliance, and other industries which require large tooling, they are called upon to make and try out some huge dies. They solved the problem with the big 1000 ton Verson Eccentric Press illustrated above.

The press measures 180" between housings. Stroke of the slide is 24", and it operates at 8 strokes per minute. The press is equipped with a Verson die cushion in the bed to permit drawing operations to be performed. The huge press weighs over 350,000 pounds.

When photographed, three sets of dies for automobile grills were being tested. While these dies are used singly in production, the large size of the press permitted simultaneous testing.

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